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CALIFORNIA FISH AND GAME

"CONSERVATION OF WILD LIFE THROUGH EDUCATION"

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THE STRIPED BASS SUPPLY OF CALIFORNIA [1]

By J. A. Craig

(With three graphs.)

The striped bass, *Roccus lineatus*, first appeared in California in 1879, when 132 of these fish were collected in the Navesink River, New Jersey, and shipped to this state. About twenty-five of the fish died and those that survived the transcontinental journey were planted in the Straits of Carquinez at Martinez. Three years later a plant of about three hundred fish was made in Suisun Bay at Army Point.

Evidently the new habitat in which these fish found themselves proved to be extremely suitable to their welfare. This is indicated by the fact that as early as 1889, or only ten years after the first plant, a

[1] Contribution No. 73 from the California State Fisheries Laboratory, September 10, 1928.

commercial catch of 16,296 pounds was reported by the United States Bureau of Fisheries. In 1892 the yearly catch was given by the same agency as 56,209 pounds.

A rough idea of the rapidity with which the striped bass multiplied, during the years immediately following their introduction, can be obtained from these figures of total catch. The fish constituting the catch of 1892 were estimated to average [2] about ten pounds in weight. Therefore, in 1892 there were about fifty-six hundred fish taken in the commercial catch. This number of fish represents only part of the annual increase of the population since the striped bass undoubtedly have become more abundant since that time.

When we consider the fact that the entire population originated from a group of less than five hundred individuals, planted ten and

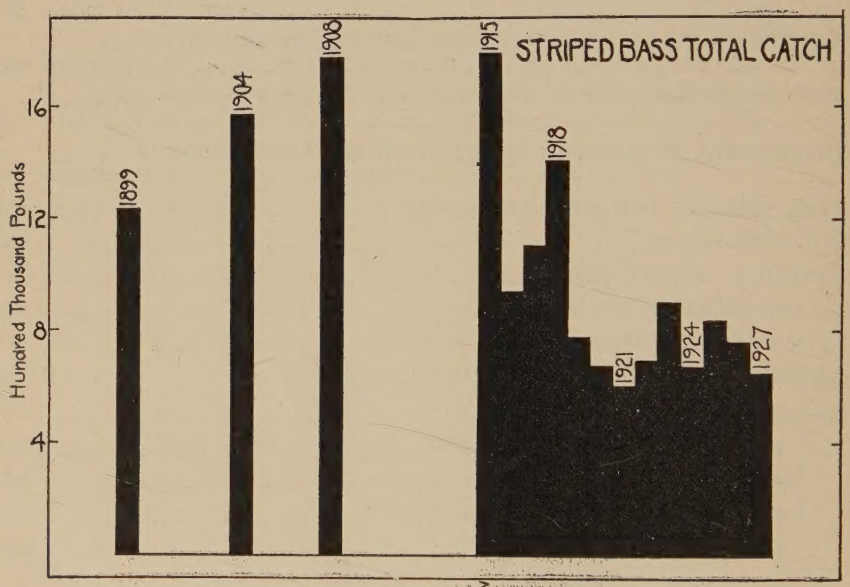

FIG. 77. Yearly total commercial catch of striped bass in California. The figures for 1899, 1904 and 1908 were compiled by the United States Bureau of Fisheries. From 1915 to 1927, inclusive, the data were compiled by the Division of Fish and Game of the Department of Natural Resources of California.

twelve years before, it is evident that the striped bass must have been placed in extremely suitable surroundings, containing an abundant food supply, ample spawning beds, favorable temperature and hydrographic conditions and very few natural enemies.

The introduction of striped bass into California probably has been rivaled only in success by the bringing of the shad into the same waters and the planting of rainbow and other trout in New Zealand.

As shown in figure 77, the total yearly catch of striped bass reached the sum of 1,234,320 pounds in 1899. The catch then rose to 1,570,404 in 1904, and 1,776,000 in 1908. The next yearly catch total available was 1915, which was 1,784,448. In 1916 there was a pronounced drop in total catch to 941,849 pounds. The catch of 1917 was of about the

[2] Report of the United States Commissioner of Fish and Fisheries, for the year 1893.

same magnitude, and 1918 showed a decided gain, totaling 1,407,841 pounds. From 1919 to 1927, inclusive, the yearly catch fluctuates without a great deal of variation around a mean of about 725,000 pounds.

From an inspection of figure 77, one might be apt to conclude that the striped bass have decreased in abundance since 1915, because the total catch falls off to such a great extent. However, total yearly catch figures are very seldom an accurate criterion of the abundance of a species of fish.

This is necessarily so, when we consider the fact that the abundance of a fish is only one of the many factors which determines the magnitude of the yearly catch. Increased fishing effort, that is, more men, boats and gear entering a fishery, may cause the yearly catch to become greater while the abundance of fish really is growing steadily less. Economic conditions, such as falling off in demand for a particular fish, sometimes bring about a drop in price, which leads the fishermen to turn to another fishery, with the result that less effort is expended and the total catch declines, while the abundance of the species remains unchanged. Poor weather conditions may cause a light catch while the supply of fish remains constant, or a strike of the fishermen may halt all fishing operations for a time, with a small yearly catch resulting. Also restrictive legislation, such as closed seasons, prohibition of effective gear or closing of productive fishing areas, may cause a decline of total yearly catch, while the abundance of the species is constant or even increasing.

The next step then is to see what factors other than the abundance of striped bass may have influenced the catch figures shown in figure 77. Changes in fishing effort, that is, fluctuations in amount of men and gear employed in the fishery, are often one of the major causes of variations in total catch. From data collected by the United States Bureau of Fsheries, Mr. C. B. Tendick, Pacific Coast representative of the Bureau of Fisheries, estimates that in 1915 there were approximately two hundred and sixty-five gasoline engine powered boats and four hundred and eighteen sail and row boats employed in the striped bass fishery in California, and in 1926 about two hundred and seventy-six gasoline boats and only four sail and row boats.

This shows an increase of only about eleven power boats and the almost complete loss of the fleet of over four hundred sail and row boats. While these figures are merely estimates there is no doubt but that there are fewer men and boats employed in the striped bass fishery now than in 1915. This is certainly one of the contributing causes tc the decline in total catch since 1915.

Doubtless there are several reasons for the loss in number of men and sail boats from the striped bass fishery. The majority of the sail boats were remodeled and fitted with gasoline engines. Then during 1915 and the years immediately following, there was an extensive development of the fisheries of Monterey, chiefly salmon trolling and sardine fishing. This induced a large number of the fishermen to leave the bass, salmon and shad fisheries of San Francisco Bay and its tributaries, which is the only commercial fishing area for striped bass in the state, and move to Monterey. Also there was a great deal of restrictive legislation passed concerning striped bass fishing following

1915, and a number of the fishermen probably abandoned their occupation and turned to more lucrative pursuits.

Unquestionably the chief cause of the drop in total catch from 1915 to 1919 was restrictive legislation. The first legislative measure protecting striped bass went into effect as early as 1893, when San Francisco County passed an ordinance prohibiting the sale of striped bass under eight pounds in weight. In 1895 a three-pound size limit was made state wide by the State Legislature, and it was also made unlawful to take striped bass commercially between sunrise on Saturday and sunset of the following Sunday. Since that time at almost every legislative session there has been some added protection given the striped bass in the form of additional closed seasons, regulation of gear or withdrawal of fishing areas from commercial fishing.

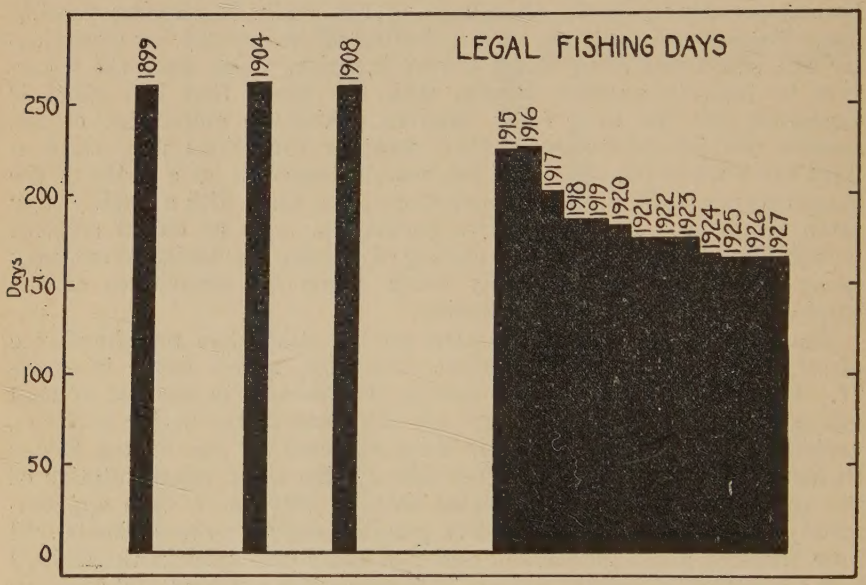

FIG. 78. Number of days in each year upon which commercial fishing for striped bass could be carried on legally in California.

Some idea of the extent to which added closed seasons have lessened the number of legal fishing days can be gained from figure 78. In 1899, 1904 and 1908, the only closed days were the Saturdays and Sundays, which left about two hundred and sixty-one days available to the fishermen. Then more closed seasons were added until in 1927 there were only one hundred and sixty-four days during the year in which commercial fishing could be legally done. Therefore, in 1927 the number of legal fishing days was only 63 per cent of the days available to the fishermen in 1908.

This would tend to cut down the yearly catch, since a man can not be expected to catch as many fish in one hundred and sixty-four days as he formerly did in two hundred and sixty-one days. Also a large part of the closed days were taken from a portion of the year, May 16 to July 31, inclusive, when the bass are abundant on the fishing grounds and fishing conditions are usually good. Therefore, the effect of the

closed season on the yearly catch would tend to be even more than the indicated loss of about one-third of the yearly fishing time.

Another series of legislative changes which have had a large influence on the yearly catches, are the measures prohibiting commercial fishing in many of the best fishing grounds. In 1911 it was declared unlawful to fish commercially in Cache Slough, Napa or Mokelumne rivers. In 1915 all commercial fishing was restricted to San Francisco Bay and the main channels of the Sacramento and San Joaquin rivers. This made it unlawful for the commercial fishermen to utilize many square miles of the most productive fishing areas, and probably had more to do with the drop in yearly catches than any other single piece of legislation.

Then in later years District 2 was closed to commercial fishing. In 1927 commercial fishing was prohibited in the greater portion of San Pablo Bay. This legislation removed another choice area from the commercial fishing grounds.

Besides the two major restrictions, of closed seasons and curtailment of fishing area, other less important protective measures, such as a closed season for commercial fishing for bass over ten pounds in weight between April 1 and May 31, and regulation of gear which may be used, have been passed by the state legislature, since the year when extremely high total catches were made.

Since the protective measures passed alone seem to be a sufficient reason for the lessened yearly catch of the last ten years, the trend of the total catches, when other factors affecting it are considered, certainly does not seem to indicate that the striped bass have been depleted. Instead it appears that the yearly take has been curtailed by a series of wise protective measures and the withdrawal of part of the men and boats working in the fishery. To pass legislation which has the effect of diminishing the yearly take of fish and then become alarmed because the catch falls off is no more sensible than for a man to become worried over his financial condition because he has deposited his money in a bank and so has not spent as much as usual.

As stated before, yearly total catch figures are at best a poor measure of the abundance of a species of fish. In order to obtain a definite idea of the abundance of a certain fish, more detailed and complete data than yearly total catches are needed. Also, the data must be handled in such a way that the effects of factors influencing the fishery other than the abundance of the fish, such as changes in fishing effort, gear, and number of available fishing days, are nullified as much as is possible.

Fortunately we have such detailed data in the pink ticket receipts collected by the Division of Fish and Game. These are the triplicate copies of the receipts which all fish buyers are required to make out when buying fish from a fisherman. The original is given to the fisherman who caught the fish, and the duplicate copy is kept by the buyer. The receipt shows the name of the man who caught the fish, species of fish caught, number of pounds in the catch, price paid for the fish, date of sale, and the name and custom house number of the boat. In this way the Division of Fish and Game is able to obtain a detailed record of every catch of fish sold in the state. In cases where the boats usually

go out and return on the same day, as in the striped bass fishery, this amounts to a detailed record of each boat's daily catches.

When these records of daily catches are handled in such a way that the catch of a constant unit of effort and gear during comparable periods of time is obtained, the result can be said to indicate the abundance of the species of fish, or at least the availability of the fish to the fishermen, as accurately as it is possible for any catch data to accomplish. In the process known as a boat catch analysis we have such a means of determining the yield of a constant unit of fishing gear and effort over comparable periods of time.

Figure 79 shows graphically the result of a simple boat catch analysis of the striped bass fishery of San Francisco Bay and its tributaries. The first step in obtaining these results was to go through the individual boat records and select twenty boats which had fished for striped bass continuously through all of the years during which the ticket system has been in operation, 1920 to 1927, inclusive. The boats so selected have been under the same owner and have used practically the same sort of gear during this eight-year period. This selection of data eliminates fluctuations due to increases or decreases in number of men or boats and changes of gear in the fishery, and provides a constant unit of gear and personnel with which to work.

The next step is to get the data in such a form that the result will show the catch of a constant unit of time. It can be easily seen that if the total catch of these boats for a year or month or week were used, the results from year to year or month to month would not be comparable because some years or months might contain many more days, when fishing was actually carried on, than others. The average catch per day during each year is the unit of time shown in the curve in figure 79. In computing this average, only those days upon which catches were reported were used, since we have no means of knowing when fishermen went out and failed to catch fish. However, it is safe to say that the great majority of times when no catches are reported, represent days on which the fishermen did not go out, because of engine trouble, mending nets, vacations, additional closed seasons and various other causes. The number of times when they fished and caught absolutely nothing are very few and would average about the same for each year over a long period of time, so they are of relatively little importance.

Some boats habitually bring in much larger catches than others, either because they have larger nets or more men in the crew, are larger boats or are operated by more skilful fishermen. If the boats making the larger catches did not make as many catches as usual in some year, the combined average daily boat catch of that year would be lowered artificially, while if some of the smaller boats made less than the usual number of catches, the average would be raised because the normal amount of small catches would not be present. Also small fluctuations in small catches should be as indicative of the abundance of the fish as larger fluctuations in larger catches. Therefore, the catches of all of the boats were weighted in such a way that all boats had equal weight in determining the final result.

The method of accomplishing this was as follows: First, the average catch per day of each boat during the eight-year period, 1920 to 1927,

inclusive, was computed by adding up the daily catches of each boat made during that period and dividing the sum of the catches by the number of catches included in the total. The boat then having the largest average daily catch during the eight-year period was given a weight of one. The daily averages of each of the other boats were then divided into the average of the boat with the largest catch in order to find out how much greater the average catch of the boat given the weight of one was than the averages of each of the others. The results of these divisions were then used as factors by which the catches of all of the boats could be raised to an equal footing with each other, and with the boat having the largest catches.

For example: Suppose boat A has the largest average daily catch of 200 pounds. Then boat B has an average daily catch of 100 pounds during the eight-year period. The factor for boat A is 1, since it has the highest average catch. For boat B the factor is 200÷100 or 2. By multiplying all of the catches of boat B by 2 they can be raised to an

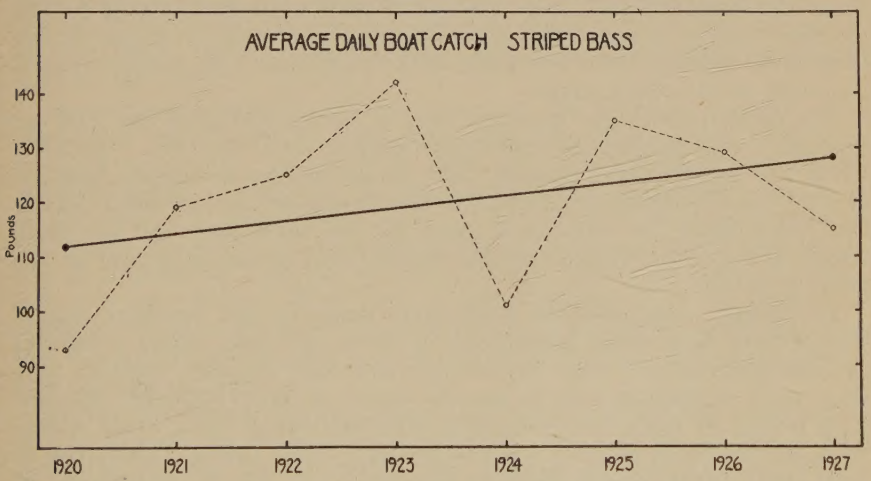

FIG. 79. Average daily catch per boat of striped bass in San Francisco Bay and its tributaries.

equal magnitude with the catches of boat A and fall about the same mean as those of boat A, and both boats will have an equal weight in determining the final combined average of all of the boats.

This process of course is repeated with the data of each of the remaining boats.

When the catches of all of the boats had been weighted so that all boats have equal importance in determining the final average, the next step was to compute the average daily catch of all of the boats for each year. This was done by adding up the weighted daily catches of all of the boats in one year and dividing the sum so obtained by the number of catches included in the total. This was repeated with the data for each year.

The dotted line in figure 79 shows the result of this boat catch analysis. In 1920 the average daily catch per boat was only 93 pounds. This increased to 142 pounds in 1923 and then it dropped to 101 pounds in 1924. The year 1925 showed a marked increase to 135 punds, and

1926 and 1927 were somewhat lower with 129 and 115 pounds, respectively.

The solid line in the same figure indicates the straight line that best fits the points determined by the dotted line. M the slope of the line was computed from the formula $M = \frac{\Sigma xy}{\Sigma x^2}$, x being the deviations of the years from their midpoint in half years and y being the deviations of the yearly average daily catches from the mean of the eight values given for these averages. The trend of the solid line in figure 79 is more significant in giving a general picture of the abundance of striped bass than the dotted line showing the exact status of the average daily boat catch for each year since it summarizes the trend of these separate points. Also some of the yearly results are influenced by factors other than the availability of the fish to the fishermen. As an example of this, during 1924 there was very little rain and a resulting condition of low, clear water which was not favorable to large catches of striped bass. Also in 1927 very large catches of shad were made which caused the fishermen to concentrate on shad fishing and to go to places where large shad catches could be made, even though the bass catches resulting were smaller than usual.

The catch return per constant unit of effort and gear has had an upward trend during the eight-year period, 1920 to 1927, inclusive. From this we can safely assume that the abundance of striped bass, or at least the availablity of the bass to the fishermen has increased during that time, since the same gear used by the same men for the same length of time has brought catches whose trend in size is greater as the years progress.

To briefly summarize the statements made in the previous pages: The striped bass when introduced in 1879 and 1882 found a habitat extremely suitable to their welfare and increased rapidly, until in 1899 they were supplying a total annual catch of over 1,200,000 pounds. This period of large yearly catches continued until 1915, after which, with the exception of 1918, the catches were much lower. This drop in total catch upon careful analysis appears to be due to withdrawal of men and boats from the fishery and restrictive legislation. During the years from 1920 to 1927, inclusive, the catch per unit of gear and effort for a constant unit of time has become greater, which strongly indicates an increased abundance or availability of bass to the fishermen.

Certainly there appears no reason to fear that the fishery is being depleted. Rather it seems that through wise protective measures the total catch is being held to a level low enough so that the supply of bass is at least holding its own and probably slightly increasing, which it might be expected to do, unless too great a strain is placed on it, until the species becomes numerous enough to fill its new habitat and completely utilize the food, spawning grounds and environment available to it.

GRUNION ON CABRILLO BEACH [1]

By Frances N. Clark.

Although much has been written [2] of the habits of the grunion, that unique fish found spawning on the sandy beaches of Southern California, this year has added a new item to our knowledge of the adaptability of this unusual fish.

The grunion deposits its eggs in the sand at the upper edge of the zone reached by the highest tides and appears on the southern California beaches in two-week intervals from March to August of each year. The spring tides, which accompany the full and dark of the moon, are the time tables by which the grunion runs can be predicted. For about an hour after the turn of the tide on the three or four nights following the full and dark of the moon, these little fish are to be found washed up on the beach, the female digging tail first into the sand and depositing her eggs, which the male fertilizes as he lies arched around her. Succeeding tides bury the eggs more deeply in the sand where they lie until dug out two weeks later by the next series of high tides. At this time the eggs hatch and the tiny fish are washed back to the sea.

Many have speculated on the question: Do grunion hatched on a particular beach return to the same beach to spawn when they have reached maturity? It has been definitely demonstrated that Pacific salmon [3] spawn not only in the same stream, but in the same tributary of the stream in which they hatch. Eels [4] migrate thousands of miles to deposit their eggs in the same region of the ocean where they began life as tiny larvae. If two species of fishes have such strong homing instincts, may this not hold true for other species also? An answer to the question as to whether or not the grunion are home beach spawners has been furnished, in part at least, by observations made in the spring and summer of 1928.

During the spring and summer of 1927, a new beach was constructed at the base of the breakwater protecting Los Angeles Harbor. This beach, known as Cabrillo Beach, was filled in by pumping sand from the channel of the harbor, and laying it down at the foot of the bluff both on the harbor and ocean sides of the breakwater. The beach on the harbor side is well protected with almost no surf. On the ocean side, the surf is heavy and the slope of the sand where the waves break relatively steep—a condition which would seem scarcely favorable for spawning grunion, as the water washes back too quickly for the fish to readily maintain their position preparatory to the spawning process.

Although the beach appeared unsuitable and the possibility that grunion would so quickly populate a new beach seemed remote, the writer made observations on the favorable series of tides during the

[1] Contribution No. 72 from the California State Fisheries Laboratory, August, 1928.

[2] Thompson, Will F., assisted by J. B. Thompson. The spawning of the grunion. Calif. Fish and Game Comm. Fish Bull. No. 3. 1919.
Clark, Frances N. The life history of *Leuresthes tenuis*, an Atherine fish with tide controlled spawning habits. Calif. Fish and Game Comm. Fish Bull. No. 10. 1925.
Clark, Frances N. The conservation of the grunion. Calif. Fish and Game, Vol. 12, pp. 161–166. 1926.

[3] Gilbert, Charles H. Contributions to the life-history of the sockeye salmon. (No. 5) British Columbia Comm. Fish. Report, 1918, pp. 26–52.

[4] Schmidt, J. The breeding places of the eel. Phil. Trans. Roy. Soc. London, 211-B, pp. 179-208. 1922.

spawning season of 1928. Until the night of June 5, many fruitless visits had been made to Cabrillo Beach, but on that night grunion were seen for the first time, and that these fish are not strictly home beach spawners was thus demonstrated. This first run of grunion was remarkably large, the fish appearing by the thousands. The run began about fifteen minutes after the turn of the tide and lasted about an hour.

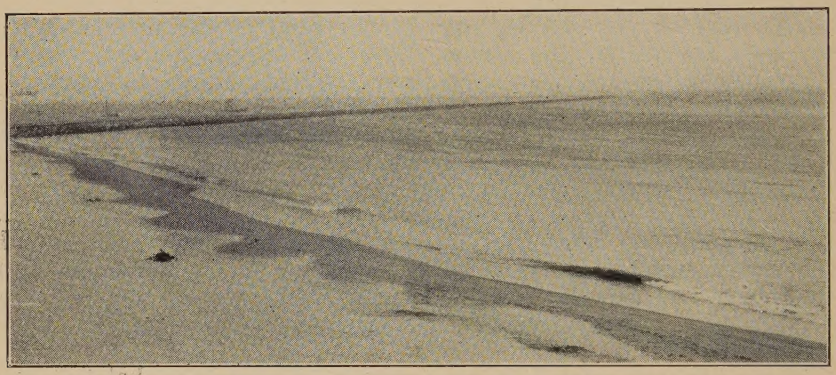

FIG. 80. Cabrillo Beach at San Pedro, California. An artificial beach appropriated by the grunion as a spawning ground. August, 1928.

Fish were observed on the ocean side of the breakwater only and none were found on the protected inner beach. On the following night, a second good run was seen although only about half as great as on the previous night. Two weeks later, on June 20, another run occurred which was small in size and lasted about a half hour. Since the peak of the spawning season had been passed, a smaller run was to be expected at this time. Again, on July 4, a small school of grunion was found spawning on this new beach.

These four observations, on three successive series of favorable tides, demonstrate quite conclusively that individuals of this group of fishes do not necessarily return to spawn on the same beach on which they were hatched, but can adapt themselves to a new beach at least a limited distance from well established spawning grounds. For several years spawning grunion have been seen on Brighton Beach and on Long Beach, approximately five and ten miles from Cabrillo Beach. But whether a new beach at a considerable distance from any spawning grounds would be appropriated immediately by grunion remains in doubt.

In addition to the interesting ecological aspects of the occupation of Cabrillo Beach by the grunion during the first spawning season following the construction of the beach, and the consequent demonstration that grunion do not always return to spawn on the beach on which they were hatched, it is encouraging to learn that these fish are still present in sufficient numbers in the region of Los Angeles Harbor to furnish the exceptionally large run witnessed on June 5. The depletion of the grunion has reached the point where the complete extermination of the fish has been feared. But with the aid of the closed season, which is now effective between April 1 and June 30, it is hoped in a few years time that the spawning runs may be built up to something of their former magnitude.

THE TOTUÁVA FISHERY OF THE CALIFORNIA GULF

Trans-Desert Trucking of Mexican-Caught Fish [1]

By Geo. Roger Chute.

(With eight photographs by the author.)

The story of the strange commencement and meteoric rise of the Totuáva [2] industry constitutes, no doubt, one of the most picturesque and interesting episodes in the history of fishing. Originating in an inhospitable and remote region, surrounded by the most discouraging natural obstacles, the traffic in this splendid food fish has leaped from inconsequential proportions into sudden gigantic maturity and arrogated to itself a position of conspicuous prominence in the fresh fish trade of southern California. So swift has been this happening that although thousands already have seen the product and come to appreciate its qualities under the name of "Mexican Bass," "White Sea Bass," or any other of several inexact designations, few persons have an understanding, as yet, of the remarkable circumstances surrounding the marketing of the great Totuáva.

State Laboratory Takes Early Interest. In the beginning days of the business, when it first was rumored that men with automobile trucks were bringing loads of big bass from out of the sweltering desolation of the Imperial valley deserts, an investigator was sent

Fig. 81. A bird's-eye view of San Felipe, taken one morning when the beach was deserted, the canoe fleet being at sea, fishing. Waiting trucks at the right edge of the picture. March 11, 1927.

from the State Fisheries Laboratory at Terminal Island, California, to view the fishery. Floods in the deserts and impassable roads defeated that original purpose, but successive later attempts resulted in a

[1] Contribution No. 74 from the California State Fisheries Laboratory, August, 1928.

[2] The accent written above the word "Totuava" (Tō-tōō-ăh'-vâh) does not occur in the Spanish spelling, but it is here applied to facilitate correct pronunciation of a foreign word, new to our language.

continuous observance being made, and a record of progress has been kept, year by year.

Mexicans Commenced the Industry. A long time ago the fishing for Totuáva had its beginning at Guaymas, that once great seaport of the Pacific which lies part way up the mainland shore of the "Mar de Cortez," as the Mexicans seem to prefer to call the Gulf of Cali-

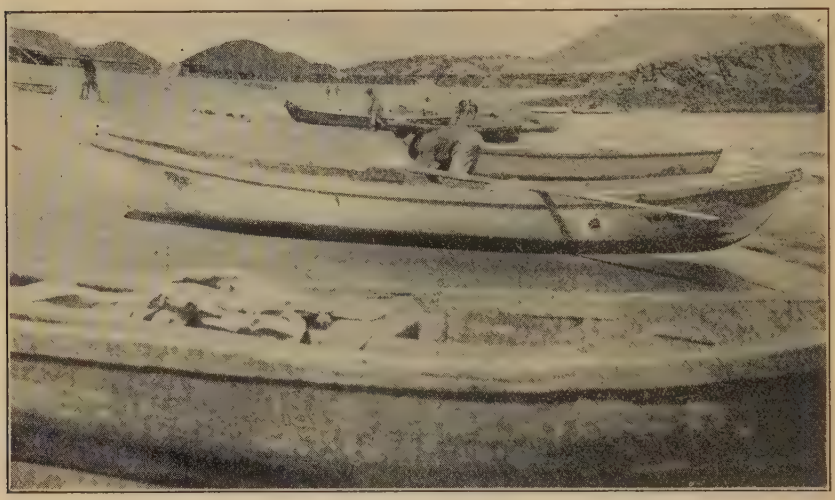

FIG. 82. Dug-out canoes of the Totuáva fishermen. These boats are brought from Jalisco, and are valued highly, since they last for more than a lifetime. Very few plank boats are used. March 12, 1927.

fornia. At Guaymas the fishing began, the Totuáva being held in high esteem by the town folk of that time. But it happened that some Chinese of the place discovered that the sound or swim-bladder of the fish was of unusual character, and not dissimilar to that of fishes in the Orient which, when properly dressed and dried, sold for astonishing prices. So the experiment was tried, and the Chinese in China took so well to the new product that a regular sound-drying business arose. Many Mexicans were induced, by the high price offered for sounds or "buche," to go to sea in dug-out canoes in quest of the fish, and it is told by residents of the ancient town that eventually so many of the Totuáva were caught that to capture more became exceedingly difficult.

Search for Undepleted Waters. By the time this seeming condition of depletion is said to have become acute a number of white men had been attracted to the fishery by the unusual profits it offered, among these being a half dozen former German seamen—adventurous and capable men who had originally come into the country to seek for gold. These sea-bred prospectors found opportunity present for winning their gold from their accustomed ocean, they engaged in the fishing in serious fashion, and when the local scarcity reduced their revenue, went sailing away into virgin waters to discover this buche-yielding fish where it might be plentiful.

Expansion of the Fishery. And they did find it. Far to the northward, on the opposite side of the gulf, and perhaps only fifty miles

from the mouth of the Rio Colorado, rich fishing grounds were discovered. At the foot of a high rock headland, in the curve of a little bay, they built shelters of desert brush, found fresh water by making a well and commenced work. Of course the fish themselves were thrown away—only the swim-bladders or sounds were saved, these being cleaned with exact care and dried in the intense heat of the desert sun. Yes, desert sun, for the little camp lay on the edge of the Baja California waste lands, broad and hot. It was a hundred miles to running water; a hundred miles to the nearest town.

Formation of Fishing Settlements. But the fishing was rich, and the venture highly productive. The Germans sailed back to Guaymas with canoes loaded with bales of "buche," and the spectacle of their splendid success so emboldened the natives that each year thereafter increasing numbers of them followed the pioneers across the gulf to the camp called San Felipe. The first season men only went, but on the second wives and children were brought, and in this way the town sprang up, growing from an original five white men to as many hundreds of Indians and Mexicans.

Waste and Destruction. It is now impossible to calculate what tons of fish these people caught and wasted. But that the slaughter was appalling can not be doubted, for great consignments of baled "buche" were sent to China from Guaymas, all of it originating at San Felipe. It is true that occasionally a few fish were steaked, and the flesh sun-

FIG. 83. Dressing Totuáva on the beach. Only the truck drivers (fish buyers) wear shoes. During the height of the winter fishing many tons are landed every afternoon. The fish sold for five cents each four years ago, but now sometimes are in demand at as much as four cents a pound.

dried for carrying home to the mainland, but this utilization was insignificant compared with the tons and tons that were cast back into the sea.

First Sale of Fish Flesh. News of the presence of the fishing camp to the southward on the gulf finally reached the border town of Calexico, and there the waste of fish was told. Two American truck-

men, haulers of melons, cotton and hay, loaded their machines with barreled water and gasoline and with an abandon that was both heroic and pathetic went down over the roadless deserts, floundered through the mud plains of the Colorado, crossed the salt flats where there is no water in ninety miles, climbed the hills, negotiated a passage through the sand dunes and finally actually arrived at San Felipe. The Mexicans were astounded.

FIG. 84. Severing the spine at the base of the head. The fish in this picture were caught by three men in three hours, quarter of a mile from shore. Practically all of the fish in this picture were males, and yielded no "buche."

Twenty Pounds for One Cent. For ten centavos each (five American cents) as many hundred-pound Totuáva were bought as the trucks could carry out, and thus, in the winter of 1924–25, the fish truck traffic began. It was a fearful undertaking—and not without much real danger—to reach the seashore camp, but the fish were abominably cheap and the Mexicans glad to sell. The Americans realized large profits.

Further Expansion. San Felipe is now a purely Mexican town, the German founders having left. These voyaged across the gulf, as they had done before, and settled a second camp called Santa Clara. The natives have followed them there, also, and now the town produces more fish than ever has San Felipe.

Some Startling Statistics. The records of the United States Customs at the entry port of Calexico show that a sportsman brought the first Totuáva across the border there in 1923. "75 pounds sea bass—2 fish" reads the meticulous record, and that ended the business for the year. But the ensuing winter, when the American truckers broke the road, the importations rose to 170,000 pounds. The next season, when twenty Mexican imitators followed the lead of the American pioneers, the quantity handled practically quadrupled. Since that time each annual increment has almost doubled the tonnage of the year before, and at present the combined product of the camps totals nearly two million pounds.

An Unconserved Resource. But the waste of fish goes on. Buche-making continues to be the main support of the fishery, for a big

sound is worth five dollars, whereas the fish itself brings only two dollars, even at present enhanced prices. Marketing the flesh of the fish is but a by-product of the buche business and serves only to enlarge the revenue of an already lucrative enterprise. So the buche-

FIG. 85. It is the fisherman's obligation, after selling his Totuáva, to deliver them to the truck. The fish are strung on the looms of long ash sweeps, for convenience in carrying. March 13, 1927.

FIG. 86. Loading the fish trucks at San Felipe. As much as 28,000 pounds of fish have been hauled out of camp in a single night. It is rarely that any ice can be brought so far, so the outward drive is a hard one, no stops being made except for a lunch until the border is reached. March 11, 1927.

making continues, wasting the resource from which it comes. During summer, when American markets are stocked with home-caught fish, the Totuáva trucks do not run. The canoes then wander away, following to Totuáva schools in their migration down the gulf. In remote

rendezvous the canoemen make their camp, buche drying racks are built and the destructive work goes on, the fish being wantonly wasted. But in the autumn the flotilla straggles home again, trailing the traveling schools northward, the arrival being timed to be coincident with the resumption of the truck trade.

FIG. 87. Fish truck caravan on the great "salitre," the wide salt desert of the middle road. Here it is 90 miles between supplies of water. High tides from the gulf occasionally flood this plain, converting it into a sea of bitter mud. March 10, 1927.

A Dug-Out Canoe Fishery. It is an odd association, this combination of rude and primitive Mexican fishery with the highly developed, specialized scheme of transportation which has been invented by the American haulers to get the fish to market. At the camps one sees the Indians and Mexicans launching their canoes at early dawn. Two or three to the dug-out, they paddle away to the grounds to handline over the side for man-sized fish. At noon they come sailing home on the inshore breeze, the catch is thrown out and dressed on the sand where the canoes are beached, and after the buches have been removed and carefully laid aside for later attention, the carcasses are sold to truckmen present at the time. Most of the haulers within the bounds of Mexico are now natives. These load the fish into small machines and commence a precipitous race for the boundary, driving against time, for the deserts are hot, the road is long, and there is no ice. Usually they succeed, but there have been many failures.

Refrigerated Transportation. At the border the American haulers are waiting. With giant trucks, carrying heat-proof refrigerator bodies, they receive the little loads of a half dozen Mexican vehicles before finally obtaining the five to six tons needed to cargo one of their own. The fish are first washed, then packed into the trucks in ice, and when evening comes the big mobile refrigerators commence the long run for San Pedro, the market. It is 237 miles from Calexico. From Yuma it is 317. Miles of hot desert must be traversed and the road leads from the shores of the Salton Sea—five hundred feet below sea level—to across the four thousand-foot mountain pass at Banning. But in

ten to fifteen hours the thing is done, for trucks leaving the border in the evening arrive at the markets at daylight the next morning!

A Record Achievement. Probably no other food fishery has sent its product to market by so striking a method. It is believed that the four-hundred-mile Gulf-to-San Pedro route is the longest motorized fish transit known and it is doubted whether there exists anywhere an express service so saving of time while crossing broad reaches of hot sand-lands to deliver a perishable sea food product in such perfect condition. Truck transit is notoriously costly and only a valuable commodity can afford its use, but the Totuáva is a superior food and a delicacy of increasing esteem and price.

Totuáva Catch of the Gulf of California by Seasons, July First of One Year to July First of the Next*

1923-24	None
1924-25	171,000 pounds
1925-26	664,000 pounds
1926-27	1,039,000 pounds
1927-28 (to April 25)	1,838,000 pounds

* Statistical data from the records of The California State Fisheries Laboratory, Terminal Island, California.

FIG. 88. Mazes of rutted roadways cover the muddy flood plains of the Rio Colorado for many miles. During the river's freshets, or following winter rains, these oozy trails can not be crossed for weeks at a time. Bogging down with heavy loads is a frequent happening here. March 10, 1927.

A NOTE ON THE SQUAWFISH AND ONE OF ITS RELATIVES

By W. I. Follett

(With four photographs by the author.)

There has been some discussion in recent numbers of California Fish and Game regarding the trout-eating propensities of the squawfish or Sacramento pike (*Ptychocheilus grandis,* Girard) of the Sacramento-San Joaquin system and certain coastal streams. Those who are interested in passing judgment on this question from their personal

Fig. 89. A typical growth of the sedge (*Carex nudata*) which is eaten by *Mylopharodon.* Near Virgilia, Plumas County, California, on east branch of north fork of Feather River. June 17, 1928.

observations should bear in mind the fact that the squawfish is not the only large Cyprinoid to be found in California trout streams.

Consider for example the East Branch of the North Fork of the Feather River at a distance of ten or twelve miles east of Belden. This stretch of the river formerly contained rainbow trout in fair numbers. That they are now almost entirely gone is attributable to various man-made causes, but the fact that they were formerly abundant will permit us to consider this a "trout stream."

In this portion of the river is to be found not only the squawfish above mentioned, which there attains a length of three feet, but also an outwardly similar species of a related genus whose food habits are substantially different. This is *Mylopharodon conocephalus* (Baird & Girard), sometimes known as the "hardhead," which in the same locality reaches a length of upwards of 18 inches—next to *Ptychocheilus,* the largest member of the minnow family (*Cyprinidae*). It might be noted in passing that the squawfish here under discussion is not the largest species of the family. That honor must go to another species of

the same genus—the socalled "white salmon" of the Colorado River basin (*Ptychocheilus lucius,* Girard), said by Jordan and Evermann to reach a length of five feet and a weight of 80 pounds. Our squawfish, however, attains proportions second only to those of this giant of the Colorado.

As may be observed from the accompanying photographs, *Ptychocheilus* and *Mylopharodon* might easily be confused by the superficial observer. The number of dorsal and anal rays, as well as the scale counts, are so nearly alike that individual variation renders this method of distinguishing the two quite unsatisfactory in the absence of a series of specimens. In general the coloration of *Ptychocheilus* tends more toward silvery upon the sides, where *Mylopharodon* is of a dusky hue, and the lower fins of the former take on an orange tinge during the breeding season, while those of the latter are dark-colored at all times. But coloration is an exceedingly variable quantity, greatly affected by such factors as light and shade, and the degree of clearness of the water. Again, generally speaking, *Ptychocheilus* has a large mouth, *Mylopharodon* a considerably smaller one. This is perhaps the most satisfactory means of hasty identification, but here we run afoul of the fact that the relative size of various parts of the anatomy of these fishes varies a great deal with the age of the individual. One of the most satisfactory methods of distinguishing the two is by an examination of the lower pharyngeal teeth. The pharyngeal bones are situ-

Fig. 90. Squawfish or Sacramento pike (*Ptychocheilus grandis*). Length (total) 15⅝ inches. East branch of north fork of Feather River, near Virgilia, Plumas County, California. June 10, 1928.

ated behind the gills, corresponding in position to a fifth gill-arch. They may be easily removed while "cleaning" the fish. In *Ptychocheilus,* the teeth borne on these bones are slender and slightly recurved, without any trace of a grinding surface. They may be termed raptatorial—adapted to seizing upon the prey which the fish has taken into its mouth. Teeth of this sort are typical of the subfamily *Leuciscinae,*

to which *Ptychocheilus* belongs. *Mylopharodon*, on the other hand, has given its name to a distinct subfamily, the *Mylopharodontinae*, both words being derived from a shortened form of the Greek *Mylopharyn-*

FIG. 91. Hardhead (*Mylopharodon conocephalus*). Length (total) 15 inches. East branch of north fork of Feather River, near Virgilia, Plumas County, California. June 16, 1928.

FIG. 92. Lower pharyngeal teeth of *Ptychocheilus* (left), and *Mylopharodon* (right).

godon, which may be translated "grinder-pharynx-tooth." How accurately this word describes the fish in question will be appreciated when one observes the enlarged molar pharyngeal teeth with flat grinding surfaces.

It has been the writer's observation that *Ptychocheilus* is an exceedingly voracious fish, a true carnivorous type. It will without hesitation seize a fish of its own kind which shows the slightest signs of being disabled, even though its prey be so nearly its own size that it is unable to swallow the victim. A good-sized piece of fresh fish "skittered" across the surface of the water, or a small live frog hooked so that it can swim, will prove an excellent bait for the squawfish.

Mylopharodon, however, is at least partly herbivorous. The writer has examined stomachs of this species which contained nothing but a mass of sedge or "tuft grass" (*Carex nudata*), the leaves of which frequently trail in the water and are readily accessible from beneath the surface. Although this fish will also take a grasshopper in lively fashion, it is not a voracious type like its relative, and will probably be found to do little harm to trout unless it be by destroying their spawn.

Whether or not *Ptychocheilus* actually devours live and uninjured young trout the writer can not say from his own observations, but there is no reason at all to doubt that it would seize a crippled trout. And on the other hand, it is an interesting fact that a piece of squawfish will often prove successful as a bait for rainbow trout at times when most other lures are of no avail.

THE BONEFISH—OVERLOOKED BY CALIFORNIA SPORTSMEN

By W. I. Follett

(With one photograph by the author.)

In volume 4 of California Fish and Game, at pages 59–60, Professor Starks describes the Bonefish (*Albula vulpes* [Linnaeus]), variously known as ladyfish, macabí, sanducha, and bananafish.

The name first given is that by which it is known to the majority of fishermen on the Florida coast, where, in relatively recent years, it has attracted an extraordinary amount of interest, and is considered one of the most desirable of game fish—in fact great numbers of anglers are said to make annual pilgrimages to Florida in quest of this fish alone.

The high esteem with which sportsmen regard the bonefish is shown by the fact that Zane Grey, in his book entitled "Tales of Fishes," describes it as "the gamest fish that swims," while Wendell Endicott, in his "Adventures with Rod and Harpoon Along the Florida Keys," considers the taking of a bonefish to be "the champagne of fishing."

It is remarkable, therefore, that it has not attracted more attention on the Pacific Coast, for it is quite generally known to occur in San Diego Bay, and the writer has on more than one occasion taken it from the south side of Terminal Island in Los Angeles harbor, while fishing for croakers and surf-fish.

In the latter locality the most successful bait for this fish, as for most others, proved to be the segmented sea-worms (*Nereidae*), known to fishermen as "pile worms" because of their being found among the

mussels and barnacles of wharf piles. In Florida, however, the hermit-crab is said to be the bait regarded with greatest favor.

As a food-fish, *Albula* has the disadvantage of being exceedingly bony, as indeed, are most of its kindred, but the flesh, like that of the shad, has an excellent flavor, and one who has the patience and skill to cope with the bones will find it much to his liking.

FIG. 93. Bonefish *Albula vulpes* (Linnaeus). Family *Albulidae*. Length (total) 15 inches. Terminal Island, Los Angeles Harbor, California. October 28, 1926.

INTESTINAL PARASITES OF WILD DUCKS AND GEESE*

By E. C. O'ROKE, Parasitologist

(Diseases of fish and game in California. Paper 2.)

While many different kinds of intestinal parasites have been reported from wild ducks and geese, our knowledge concerning the majority of them is meager and based upon random observations rather than upon concerted effort. This is not unusual. It merely represents a stage of progress comparable to that of our knowledge of the parasites of domestic poultry until in recent years.

By comparison, we are safe in saying that parasitism in wild birds just as in domesticated birds deals with matters involving many factors and relationships.

Fox† in discussing parasitism among wild geese and ducks at the

* This is the second article from the Bureau of Research on parasites of game birds. The first concerned parasites of the valley quail, and was published in the July number of this publication. We are grateful to the University of California for continued use of the laboratory facilities of the Zoology Department and to Professor C. A. Kofoid, chairman of this department, for helpful advice and for allowing the use of his personal library. Credit is due Mr. O. L. Williams of this department for finding and identifying the gizzard worms mentioned in this report.

The work on parasites is a part of a survey of game diseases which has been undertaken by the Division of Fish and Game. The study of game diseases has been made possible largely through the cooperation of the University of California. Dr. K. F. Meyer, Director of Hooper Foundation for Medical Research, has accepted an appointment as Consulting Pathologist and is supervising our pathological investigations.

† Fox, Herbert, 1923. Disease in captive wild mammals and birds (J. B. Lippincott Co., Philadelphia, Pa.), 665 pages, 87 figs. in text, pls. included.

Philadelphia Zoological Gardens gives figures showing that of the birds that died in a given period of time at the gardens, 15 per cent of the geese and 4 per cent of the ducks were parasitized with various kinds of flukes and tapeworms.

This situation suggests further analysis. Are wild birds in zoological gardens more prone to harbor parasites than they are in their native wild state?

What kinds of parasites are present in wild ducks and geese? What about their relative numbers? What about their host and geographic distribution? How do they directly or indirectly affect the welfare of the birds?

Obviously questions of this kind can not be answered by drawing conclusions from conditions that prevail in domesticated birds or in wild birds in captivity, owing to differences in environment and feeding conditions, and the survey method is suggested as being the most logical procedure to follow.

For many years, serious losses among wild ducks have attracted the attention of those interested in their preservation. Since the nature of the malady or maladies has remained obscure, it was thought that a survey of parasites, in addition to being desirable in itself, might be of value at least indirectly or as a matter of elimination, in investigations of duck sickness that are now being carried on by this Division.

Accordingly with the opening of the duck season in 1927 a survey of parasites was begun. Sufficient progress has now been made that a report can be issued at this time. As will be seen by the accompanying map, an attempt has been made to extend the survey to areas where duck sickness has been reported as well as to places apparently free from the malady.

METHOD OF INQUIRY

With the helpful cooperation of various gun clubs, employees of the Division of Fish and Game have been able to be present on shooting days, and have thus had access to more material than they could have obtained working independently.

As the birds were brought in and the entrails removed, casual examination was made immediately for any obvious or unusual conditions occasioned by parasitism. Samples of all parasites found were then collected, preserved, and taken to the laboratory for later study.

The following table shows the results of the survey to date. Due to the unsettled condition of the literature on the Trematode and Cestode worms, no attempt has been made to classify some of the specimens into divisions lower than the genus to which the specimen belongs.

Owing to lack of space in the table, the authorities' names are not included with the genera and species. In accordance with correct usage, however, the list is included and is as follows:

Ascaridia lineata (Schneider, 1866).
Hymenolepis lanceolata (Bloch, 1782) Weinland, 1858.
Hymenolepis anatina (Krabbe, 1869) Cohn, 1901.
Zygocotyle ceratosa Stunkard.
Genus *Diorchis* Clerc, 1903.
Genus *Amidostomum* Raillet and Henry, 1909.
Genus *Notocotylus* Diesing, 1839.

CANADA GOOSE

Branta canadensis canadensis (Linnaeus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	12/4/27	Live Oak	O	--------	----	---
2	12/4/27	Live Oak	O	--------	----	---
3	12/4/27	Live Oak	O	--------	----	---
4	12/4/27	Live Oak	O	--------	----	---
5	12/4/27	Live Oak	O	--------	----	---
6	1/3/28	Jacksnipe	Thread worm *Amidostomum* sp?	Gizzard	3	---

LESSER SNOW GOOSE

Chen hyperboreus hyperboreus (Pallus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm *Hymenolepis lanceolata*	Small intestine	1	---
2	11/19/27	Los Banos	O	--------	----	---
3	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	3	---

HUTCHIN'S GOOSE

Branta canadensis hutchinsi (Linnaeus)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm *Hymenolepis lanceolata*	Small intestine	2	---
2	11/19/27	Los Banos	O	--------	----	---
3	11/19/27	Los Banos	O	--------	----	---
4	11/19/27	Los Banos	O	--------	----	---
5	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	3	---
6	11/19/27	Los Banos	O	--------	----	---

ROSS SNOW GOOSE

Chen rossi (Cassin)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Fluke *Notocotylus* sp?	At the junction of caeca	7	---
2	11/19/27	Los Banos	O	--------	----	---
3	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	2	---
4	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	7	---
5	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	3	---

PINTAIL OR SPRIG

Dafila acuta tzitzihoa (Vieillot)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	Tapeworm *Diorchis* sp?	Small intestine	5	
2	11/19/27	Los Banos	O	--------	----	
3	11/19/27	Los Banos	O	--------	----	
4	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	2	
5	11/19/27	Los Banos	Tapeworm *Hymenolepis anatina*	Small intestine.	1	
6	11/19/27	Los Banos	Nematode cyst	Outer wall of gizzard.		Unidentified.
7	11/19/27	Los Banos	O	--------	----	
8	11/19/27	Los Banos	O	--------	----	
9	11/19/27	Los Banos	Tapeworm *Hymenolepis anatina*	Small intestine	Many	Immature.
10	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	2	
11	11/19/27	Los Banos	Tapeworm *Hymenolepis anatina*	Small intestine	Many	Immature, intestine inflamed.
12	11/19/27	Los Banos	O	--------	----	
13	11/19/27	Los Banos	O	--------	----	
14	11/19/27	Los Banos	O	--------	----	
15	11/19/27	Los Banos	O	--------	----	
16	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	Individual records of these small
17	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	nematode worms from gizzards not
18	11/19/27	Los Banos	O	--------	----	kept, but the numbers ran from 2 to 5
19	11/19/27	Los Banos	O	--------	----	in each individual, numbers 16, 17, 21,
20	11/19/27	Los Banos	O	--------	----	25, 26, 27, 30, 31, 32.
21	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
22	11/19/27	Los Banos	O	--------	----	
23	11/19/27	Los Banos	O	--------	----	
24	11/19/27	Los Banos	O	--------	----	
25	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
26	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
27	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
28	11/19/27	Los Banos	O	--------	----	
29	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
30	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
31	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
32	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	----	
33	11/19/27	Los Banos	O	--------	----	
34	12/ 4/27	Live Oak	O	--------	----	The gizzards of Nos. 34–37, inclusive,
35	12/ 4/27	Live Oak	O	--------	----	not examined.
36	12/ 4/27	Live Oak	O	--------	----	
37	12/ 4/27	Live Oak	Tapeworms *Hymenolepis anatina*	Small intestine	3	
38	12/ 4/27	Live Oak	O	--------	----	
39	12/ 4/27	Live Oak	Tapeworms *Hymenolepis anatina*	Small intestine	2	
			Caecum worms *Ascaridia* sp?	Caecum	7	
40	12/ 4/27	Live Oak	Tapeworms *Hymenolepis anatina*	Small intestine	2	
41	12/ 4/27	Live Oak	O	--------	----	
42	12/ 4/27	Live Oak	O	--------	----	
43	12/ 4/27	Live Oak	O	--------	----	
44	12/ 4/27	Live Oak	O	--------	----	
45	12/ 4/27	Live Oak	Tapeworms *Hymenolepis anatina*	Small intestine	3	
			Caecum worms *Ascaridia* sp?	Caecum	1	

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
46	12/ 4/27	Live Oak	Tapeworms *Hymenolepis anatina*	Small intestine	4	
47	12/ 4/27	Live Oak	?	--------	----	
48	1/ 4/28	Jacksnipe	O	--------	----	Hard tumor on mesentery probably
49	1/ 4/28	Jacksnipe	O	--------	----	caused by parasitic nematode.
50	1/ 4/28	Jacksnipe	O	--------	----	
51	1/ 4/28	Jacksnipe	O	--------	----	
52	1/ 4/28	Jacksnipe	Fluke *Zygocotyle ceratosa*	Small intestine	1	
53	1/ 4/28	Jacksnipe	Thread worm *Amidostomum* sp?	Gizzard	?	Lining of intestine a mass of scar tissue.
54	1/ 4/28	Jacksnipe	O	--------	----	It is interesting to note that this lot
55	1/ 4/28	Jacksnipe	O	--------	----	of sprig, Nos. 48–53, taken on the salt
56	1/ 4/28	Jacksnipe	O	--------	----	marshes, are not as heavily para-
57	1/ 4/28	Jacksnipe	O	--------	----	sitized as other lots taken on fresh
58	1/ 4/28	Jacksnipe	O	--------	----	water in the inland valleys.
59	1/ 4/28	Jacksnipe	O	--------	----	
60	1/ 4/28	Jacksnipe	O	--------	----	
61	1/ 4/28	Jacksnipe	O	--------	----	
62	1/ 4/28	Jacksnipe	O	--------	----	
63	2/11/28	Bakersfield	O	--------	----	Protozoan parasite.
64	2/11/28	Bakersfield	Ameba	Caecum	Many	Species unidentified.
65	2/11/28	Bakersfield	Ameba	Caecum	Many	
66	2/11/28	Bakersfield	O	--------	----	No worm parasites found in this lot.
67	2/11/28	Bakersfield	O	--------	----	
68	2/11/28	Bakersfield	O	--------	----	

AMERICAN WIDGEON

Mareca americana (Gmelin)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1	11/19/27	Los Banos	O	--------	----	This lot of widgeons, numbering in
2	12/ 4/27	Live Oak	O	--------	----	all 15 from three different localities,
3	12/ 4/27	Live Oak	O	--------	----	showed no parasitism of any kind.
4	12/ 4/27	Live Oak	O	--------	----	
5	12/ 4/27	Live Oak	O	--------	----	
6	12/ 4/27	Live Oak	O	--------	----	
7	1/ 3/28	Jacksnipe	O	--------	----	
8–15	1/ 3/28	Jacksnipe	O	--------	----	

GREEN-WINGED TEAL

Nettion carolinense (Gmelin)

No. of bird	Date	Locality	Species of parasite	Location	No. of Parasites	Remarks
1–7	11/19/27	Los Banos	O	--------	----	
8	11/19/27	Los Banos	Thread worm *Amidostomum* sp?	Gizzard	1	In all 23 teal from three localities
9–14	11/19/27	Los Banos	O	--------	----	were examined with only one record
15–18	12/ 4/27	Live Oak	O	--------	----	of parasitism.
19–23	1/ 3/28	Jacksnipe	O	--------	----	

MALLARD

Anas platyrhynchos (Linnaeus)

No. of bird	*Date*	*Locality*	*Species of parasite*	*Location*	*No. of Parasites*	*Remarks*
1	1/ 3/28	Jacksnipe	O	--------	----	----------

CANVASBACK

Mari a valisineria (Wilson)

No. of Bird	*Date*	*Locality*	*Species of parasite*	*Location*	*No. of Parasites*	*Remarks*
1	1/ 3/28	Jacksnipe	O	--------	----	----------
2	1/15/28	Vallejo	Tapeworms *Hymenolepis* sp?	Small intestine	3	----------
3	1/15/28	Vallejo	Tapeworms *Hymenolepis* sp?	Small intestine	12	----------

SHOVELLER OR SPOONBILL

Spatula clypeata (Linnaeus)

No. of bird	*Date*	*Locality*	*Species of parasite*	*Location*	*No. of Parasites*	*Remarks*
1	11/19/27	Los Banos	O	--------	----	----------
2	12/ 4/27	Live Oak	O	--------	----	----------
3	12/ 4/27	Live Oak	O	--------	----	----------
4	1/ 3/28	Jacksnipe	O	--------	----	----------

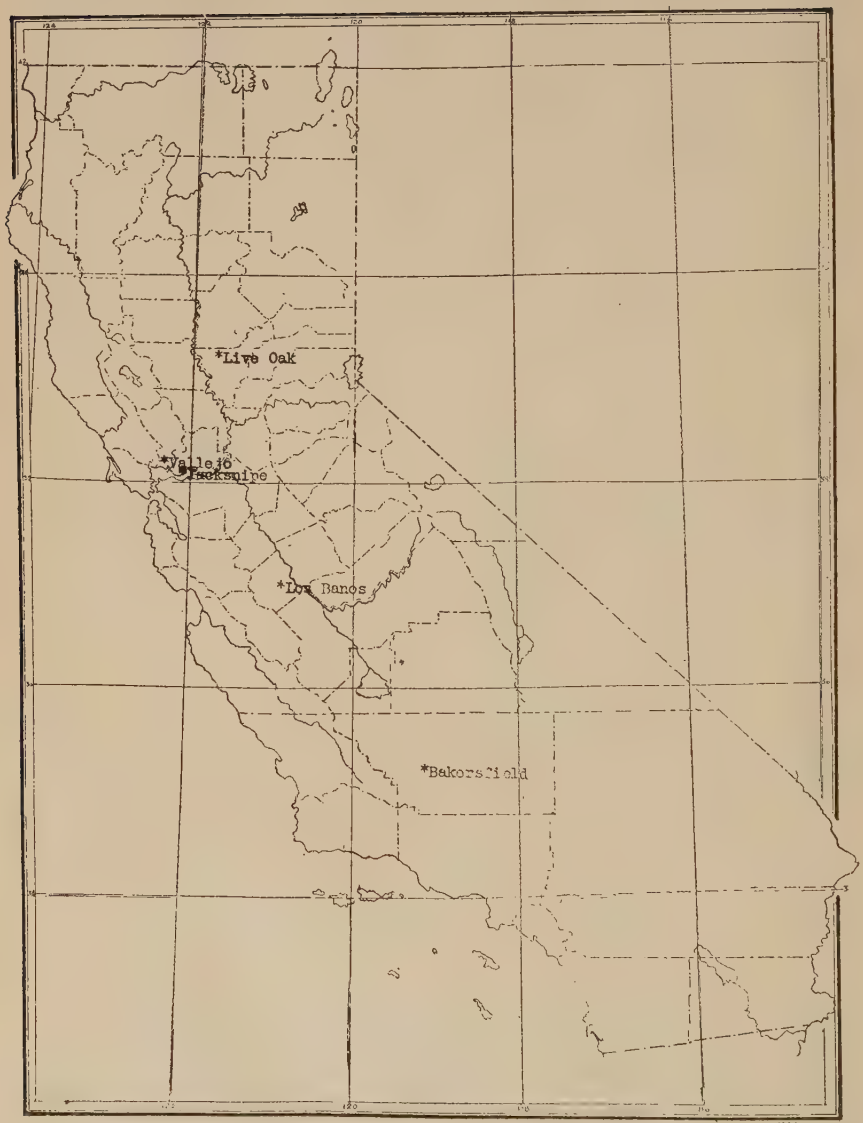

FIG. 94. Outline map of California showing locations where collections of parasites of ducks and geese have been made.

While the preceding table shows the numbers of different species of birds examined and the conditions of parasitism with regard to each, it does not take into consideration several interesting comparisons which are apparent when the subject matter contained in the table is rearranged.

Disregarding kinds of parasites and arranging a table to show the number of birds of each species that were examined and the percentage parasitized, the tabulation is as follows:

Species of bird	*Number examined*	*Number parasitized*	*Per cent parasitized*
Mallard	1	0	.0
Spoonbill	4	0	.0
Widgeon	15	0	.0
Green-winged teal	23	1	4.3
Canada goose	6	1	16.6
Hutchin's goose	6	2	33.3
Pintail	68	42	62.0
Lesser snow goose	3	2	66.6
Ross snow goose	5	4	80.0
Totals	131	52	39.+

A further analysis of this table shows that with the single exception of the Canada goose, all of the geese are in the group that shows a high percentage of parasitism. If these figures represent an average sample of the conditions of parasitism obtaining among our common waterfowl, it would seem that the pintails and the geese are more susceptible to parasites than the others are. This condition might have its explanation in relative immunity or in differences in feeding habits.

As to correlations existing between the conditions of parasitism found and the localities studied, the collections from Vallejo and Bakersfield were so small as to be of doubtful value for comparison with those from other localities. Fortunately, Live Oak, Los Banos and Jacksnipe afford interesting data for comparing conditions in the Sacramento and San Joaquin valleys and in a typical salt-water marsh area. The figures are as follows:

Locality	*No. of birds examined*	*Number parasitized*	*Per cent parasitized*
Jacksnipe	26	3	11.5
Live Oak	29	8	27.6
Los Banos	63	26	41.2

It would seem from this table that parasitism is more common in birds that frequent inland bodies of fresh water than it is in those that live habitully on the salt marshes. Also it appears that birds are more heavily parasitized in the San Joaquin Valley than they are in the Sacramento Valley. The various matters of migrations, feeding habits, summer conditions, etc., are so complicated that it is indvisable to draw too many conclusions from one season's work with a limited number of birds.

Referring back to the original table, it will be noticed that by far the most common parasite found was the small thread worm *Amidostomum* sp? This form is almost microscopic in size, about the diameter of ordinary sewing thread, and lives embedded in the inner surface of the gizzard just at the edges of the grinding pads. They averaged

from one to five per parasitized bird, and the records show that this form was found in twenty-three different birds belonging to six different species.

The tapeworm *Hymenolepis anatina* was next in abundance, being found eight times, but only in pintail ducks. Four specimens were the most found in any one bird with the exception of two cases where the tapeworms were immature, and so small that an accurate count was not made.

Another tapeworm *Hymenolepis lanceolata* was found but twice in two different species of geese. The round worm *Ascaridia* sp? was likewise found but twice in only one species of bird.

All other records are based upon finding the parasite only once and in one host only.

From the foregoing tables and discussion it will be seen that intestinal parasites are present in nearly all species of our ducks and geese commonly taken during the hunting season. The fact that no parasites were found in the small numbers of mallards, spoonbills and widgeons examined does not necessarily mean that these birds are not parasitized. Another season might show a higher percentage of these birds in the bag and parasites in proportion to their number. No cases were found where mature parasitic worms were really abundant. With two or three exceptions the parasitized birds seemed to be in as good condition as the unparasitized ones.

The above studies being made in late fall and winter with mature birds give, of course, no picture of the situation that may prevail among the young birds in early summer where parasitism may be of considerable importance. In this connection it may be said that the life cycles of parasites and the susceptibility of various hosts to infection by such parasites are the factors to be considered. The life cycles of only a few of the worm parasites of birds are known, and all of these involve complex factors of food relationships of the birds and the things upon which they feed.

From the standpoint of intestinal parasites, the survey thus far has disclosed no apparent relationships existing between duck sickness and the presence of parasites.

As has been mentioned previously protozoans, particularly amebae have been found in the digestive tracts of two sick ducks from Buena Vista Lake that were being kept under observation. This is of interest and suggests the desirability of making more extensive collections of these organisms than was done in last season's work. To do this will involve the use of special equipment in the field for making up the material on microscope slides and preserving it immediately after the birds are killed.

Those who observed the collecting of parasites in the field last year will recall that it is a comparatively simple matter. The following diagram will give an idea as to the relationships of the parts of the digestive tract and the places where parasitic worms may be found.

The intestinal tract is removed from the bird and placed in a pan of water. It is then slit open with small scissors and examined in the water. Using a pipette or medicine dropper to squirt little jets of water into the opened intestine serves to free the parasites from the surrounding material. When a parasite is found, it is washed free,

lifted out by means of a camel's hair brush and placed in the preserving fluid. Round worms and flukes can be handled with a small pair of forceps, but tapeworms are usually broken by this method of handling. The greatest danger of destroying tapeworms as specimens in the process of collecting them is to break off the scolices (heads) which are attached to the intestinal wall. It is important that these heads be intact for they are invaluable for identification.

For collecting the small gizzard worms, a sharp-pointed pair of forceps should be used.

Four per cent formaldehyde makes a good fixing and preserving fluid. An important thing to remember is that a generous amount of

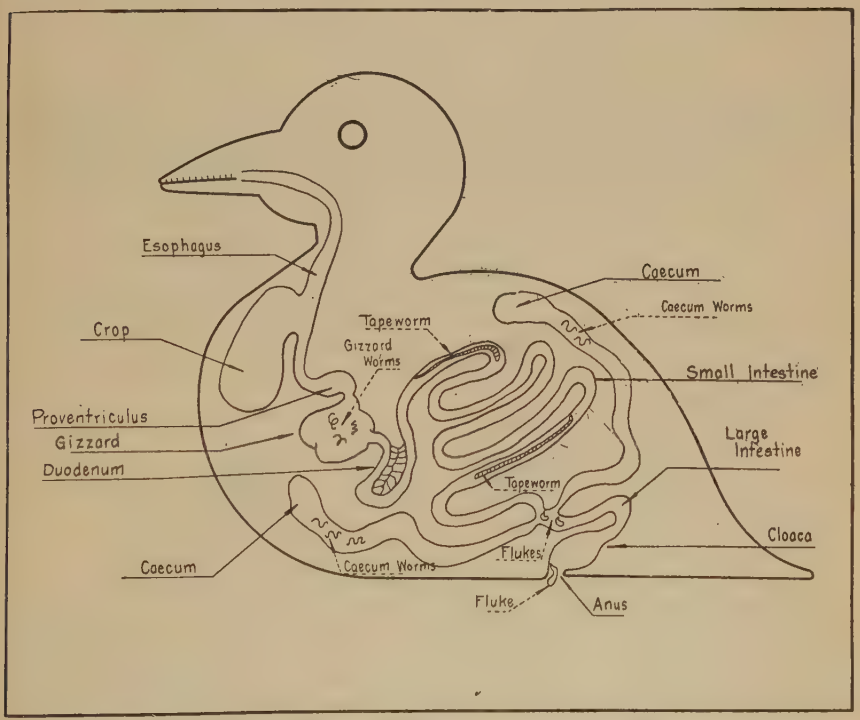

FIG. 95. Diagram of intestinal tract of duck showing places where parasites may be found.

the preserving liquid should be used. About ten times as much liquid as the bulk of the specimens is the correct amount to use. Most important of all is exact labeling, stating the host bird, the locality, date, the place in the host where the parasite is found, and the collector's name.

Interest taken by sportsmen and others in the parasite survey of game birds will be appreciated by the Division and we will also be glad to obtain any specimens that may be sent in.

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Fig. 96. Rescuing fish from overflow area. August, 1928.
Photograph by George Neale.

FISH RESCUE AND RECLAMATION

By George Neale

(With three photographs by the author.)

While the Division of Fish and Game has previously been engaged in fish rescue work principally of black bass, its purpose was, primarily, to fill requisitions for the stocking of barren waters or for replenishing those waters which were over fished more than from a conservation viewpoint. No funds had been available or organization created to carry on the work.

The work of rescue and distribution was carried on for a number of years out of Sacramento by the late deputy Manuel Cross and the writer. The conditions were ideal for natural propagation in both Yolo and Sacramento counties. There were more black bass, possibly, in those two counties than in all the state. A total of 507 shipments of large mouth bass were made during the years 1904 to 1912 to counties as far south as San Diego and north to Siskiyou. Up to this date the other spiny-rayed tribe, crappie and sun fishes, were not in sufficient numbers to justify their removal to other waters for stocking purposes. Since then these spiny-rayed fishes were introduced into the Sacramento and San Joaquin valleys and thrived so remarkably well, because of the natural propagating conditions existing, that the angling fraternity has learned the economic and great outdoor value

of them. Consequently, the demand has grown and increased very materially. It is not generally known that these spinous fishes can not be egged or spawn stripped for artificial propagation as are the salmon family. Nature furnishes these fish with outdoor hatcheries and the fish take advantage of flood conditions to make it possible for the parent fish to select their own spawning areas to reproduce themselves. But unfortunately, these spawning areas are not controlled by human agencies as are our hatcheries for trout or salmon. Later these overflow areas become dry through evaporation. Both young and adult fish consequently become a prey to both predatory birds and animals and thus become total loss.

From my experience in fish rescue work of over twenty years I have estimated that the *loss of spinous fishes,* striped bass, black bass, all of the crappies and sunfishes, including catfish, and all of great economic value, exceeds the output of three of our largest artificial propagating plants. Since a license is now required to angle for them and since none are artificially propagated it is logical that we should take advantage of what nature offers. This is the purpose of the "Bureau of Fish Rescue and Reclamation" work by the Division of Fish and Game of the Department of Natural Resources. I have advocated this work for many years. Many of the eastern and middle western states are engaged in this work, also the U. S. Bureau of Fisheries, and have been for many years.

California received her first shipment of spiny-rayed fishes for stocking our waters upon requisition by our fish cultural department,

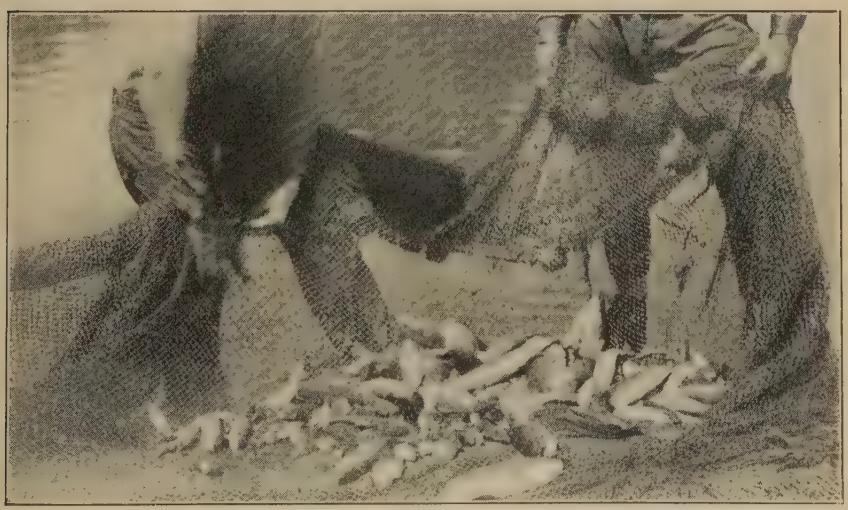

FIG. 97. A catch of fish ready to be transported to more favorable conditions. August, 1928. Photograph by George Neale.

from the U. S. Bureau of Fisheries. They have thrived in the great valleys.

During the month of August, 258,200 of these valuable fishes were saved to the anglers of the state. These have been transplanted into living waters. Several shipments have been made to southern California. The Division's fish car has distributed ten cans of crappie and

sunfish to waters above the Santa Anita dam, Los Angeles County; twenty-four cans of crappie, sunfish and catfish to Henshaw Lake, San Diego County; thirty-four cans bluegill and crappie to Diez Lake, Inyo County; thirty cans mixed fish to Big Bear Lake, San Bernardino County, and six cans of catfish to Foss Lake, San Diego County. All the above were from the overflow of the Cosumnes, Mokelumne and American river watersheds. The torrid weather during the time the work was going on made it impossible to hold the smaller fish any length of time except the catfish, or for any great distance, consequently the larger fish were shipped and the small fry returned to the nearest living waters.

Captain E. W. Smalley of Hanford has been very active in fish rescue work in his district. He reports having saved up to August 31st, 158,200 fishes, 110,200 of which were catfish, 15,000 of which were planted in Kings River, 4000 in Cross Creek, Tulare County, and 40,000 in Kaweah River, McKays Point. The other species, black bass, crappie and sunfish, were returned to the main rivers.

In the saving of the game and food fishes I would eliminate all the useless nonfood fishes that are of no commercial or food value, of which there are several. I would also condemn the rapidly growing practice of the promiscuous use of minnow seines now used for gathering bait in fresh waters. This practice is harmful for the reason that the seining destroys the spawn of the game fishes. It also kills many young game fishes caught in the seine, many of which are returned to the water dead or left to perish on the shore. Unfortunately, many species of the finny tribe have been introduced into waters contrary to existing law and with no authority. If I am permitted it will be the policy of this bureau to stock barren waters with the species of fish most adaptable to existing conditions.

CALIFORNIA FISH AND GAME

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December 10, 1928

Most of us, as we grow older, grow to care relatively less for the sport itself than for the splendid freedom and abounding health of outdoor life in the woods, on the plains, and among the great mountains. —Theodore Roosevelt.

HEAD OFFICE MOVED

On the last two days of August, the head office of the Division of Fish and Game at San Francisco was moved from the Postal Telegraph Building to the fifth floor of the Russ Building, San Francisco's new skyscraper. The new accommodations, which occupy the Bush street wing, are furnished in dark mahogany. One enters a lobby with an information desk opposite. Then follow on the left of the hallway, the license bureau, department of patrol, bureau of research, bureau of public relations, department of commercial fisheries; to the right of the hall is found the library, bureau of education, bureau of hydraulics and department of fish culture. Most of the departments are in one large room separated by railings. A suitable telephone system connects all departments. Although missing the privacy given by separate rooms, the new accommodations give a businesslike appearance. A laboratory and a dark room are additional facilities. Most of the storage room is in the basement.

The Russ Building is thirty stories high and although but eighty per cent occupied at present, accommodates 4000 people, a city in itself. It has been advertised for some time as the "business center of San Francisco."

GAME RESTORATION

Someone has coined a worthwhile phrase. The term "game restoration" aptly describes recent attempts to restore game conditions. In some instances, a stocking program backed by modern game farms is bringing back game in the cultivated areas. The phrase is also apt when describing what Utah has done in improving conditions for wildfowl. Valueless land was purchased, dikes were built and the land flooded with water to a depth of a foot. Proper conditions being furnished, wildfowl find here a suitable feeding and breeding ground. This is game restoration. There should be more of it!

OBLIGATIONS

Many people seem to have the idea that having paid their hunting and angling license fee they can put the burden of conservation and protection on the state department. These same persons, although paying little attention to season and limit laws, curse the Division of Fish and Game for allowing certain species to disappear. The state department in charge often attempts to shoulder the greater responsibility which comes with larger numbers of hunters and changing conditions which limit the food supply of game. In recent months, there has been a *concerted effort* made to stir sportsmen themselves to responsibility. Their obligation is not ended with the payment of dues in a game protective association, or the payment of a license fee. A real game restoration program is dependent upon the concerted effort of the whole body of sportsmen backed by public sentiment. A fish and game commission can only accomplish a share of the work to be done. Such an organization usually lives up to its responsibility as best it can, but some of the burden must be shouldered by those who hunt and fish.

MORE STATE PARKS NEEDED

Even though California possesses a full share of national forests and national parks, yet she is convinced that sufficient recreation grounds have not yet been set aside. Much state-owned land, which should have been saved, has become private property and necessity now forces the state to buy suitable recreation areas. Here is a state with a population of 5,000,000 which owns but five state parks. A state parks program has been formulated and voters of the state are asked to provide a bond issue of $6,000,000 in order to insure the recreational feature for her citizens. This sum is to be matched by an equal sum in private donations.

Buildings are built and rebuilt and so are roads, but when natural scenery and wild life resources are destroyed by conversion of lands to other uses, they are

gone forever and impossible to replace. This is a sound argument for immediate action. The needs of the future must be anticipated.

California is not the only state that has waked up to recreational needs. The state of Connecticut is buying and leasing her streams for the use of the public for fishing and recreation. New York has authorized bond issues aggregating $25,000,000 for forests and public parks. Pennsylvania has expended over $4,000,000 to buy forest lands, and this fall will vote upon a $25,000,000 bond issue with which to purchase 3,500,000 acres. The voters of Illinois will decide upon a $20,000,000 bond issue to be redeemed from the fish and game fund with which to purchase lands and waters for fish and game refuges and for recreational uses. The necessity for such progress is evident and affirmative action is to be expected. Recreation areas are necessary and now is the time to act!

FIG. 98. Truck with rescued fish ready for transportation to live waters. August, 1928. Photograph by George Neale.

DIVISION'S WORK SUBJECT OF VISUAL STUDY

During the forty-day display of the Pacific Southwest Exposition, Long Beach, thousands of visitors learned of the work of the division in the protection and production of fish and game resources. Three harmonized, realistic groups, occupying almost one entire side of the California Building, with appropriate natural and artistic settings and panoramic backgrounds, exhibited fish cultural operations, game bird propagation and the effect of forest fires on fish and game.

An accurate portrayal of the brood pond system at the Mount Shasta Hatchery was conveyed by a large cement pond containing brood trout of the German brown variety lazily swimming about. Other ponds painted in the canvas backgrounds with hatchery buildings beyond and snow mantled Mount Shasta dominating the whole made a satisfying picture of the state's largest hatchery. Artificial rock work, mossed and refreshed by ferns, and the music of falling water, added a note of beauty to the scene.

Along the side wall of this set was a hatchery trough with hundreds of tiny black-spotted trout, while a hatchery basket containing eggs completed the steps in the fish cultural cycle.

Colored plates and maps with the necessary explanatory legends on the wall above the hatchery trough gave the spectator a knowledge of the scope of the division's fish cultural activities.

Visitors attracted by the colorful plumage of the golden pheasants, Chinese ringnecked pheasants, valley quail and Hungarian partridges in the game bird group, looked into a series of pens projected into the painted background and enjoyed the illusion of gazing into a game farm out of doors. Particular care was given to reproduce faithfully a section of the proposed southern California game farm near Chino, San Bernardino County.

In the central group, a striking effect was achieved by contrasting the "before and after" effect of fire. The intimate relation of a living forest and the pursuit of life by wild creatures was impressed in a way few could escape. The live animals used combined to represent in a composite way as many important species of value and interest to the sportsman as could be associated together without too great a variance from actual fact. A pair of mallard ducks with their brood of young rafted on the small pond in the foreground; a covey of quail, bobbing in and out brush and about the trees hunting for food, and a young black-tailed deer, oblivious to the attention of exposition throngs, lent a naturalness to the set and conveyed that intimate charm of wild life close at hand.

Desolation and charred trees in the burned forest area expressed unequivocally the evil that forest fires do. A deer skeleton took the place of the living animal in the live forest section. But the ducks and quail were gone. In their stead were two black vultures.

In an educational way, the exhibit accomplished much. Young and old were able to understand it and learned something of the work of the division. Many carried away with them the conviction of the need for protection and the necessity for preservation of fish and game.

The exhibit was a cooperative affair with the United States Forest Service and with the division. As a whole, it revealed a mastering idea. This achievement in symmetry and arrangement was due to the efforts of Paul J. Fair, of the Forest Service. The paintings used in the background of the three groups were done by the noted landscape artist, Frank J. Mackinzie. Rodney S. Ellsworth had charge of the exhibit for the division.

IN MEMORIAM

EUGENE WILLIAM HUNT

Death claimed one of the Division's oldest employees in time of service on September 18, 1928. Eugene William Hunt (67) field superintendent of hatcheries since 1912, began his services with the then Fish Commission as secretary to J. V. Shebley, hatchery superintendent, on August 7, 1887. He therefore rounded out forty-one years of service. "Gene" Hunt was born of a pioneer Sacramento family sixty-seven years ago. As a young man, he worked in the tax collector's and assessor's office in San Francisco. In 1901 he married Eleanor Nelson of a pioneer Marin County family in San Francisco. After becoming associated with hatchery work, he played an important part in developing the famous Battle Creek Hatchery for salmon in Tehama County. He assisted in building many of the present hatcheries. Many will remember him as superintendent of hatchery operations at Lake Tahoe. As field superintendent he has helped correlate hatchery work and improve conditions at the various hatcheries.

EUGENE W. HUNT.

E. W. Hunt was dependable, loyal to his duties and to his host of friends. His genial disposition, his many kind and charitable acts and his faculty to meet the public and his untiring devotion to his duties won him the respect and esteem of his superiors through over forty years of public life. He was a true sportsman and believed in the conservation of wild life in the fullest sense of conservation.

Eugene Hunt was a Knight Templar and a Master Mason. The funeral service was conducted by the Masonic order at his request.

Of immediate relatives, he leaves a brother, W. B. Hunt of Mt. Shasta; a sister, Mrs. Elizabeth Healy, and a nephew, Captain Jack Neely of San Francisco, to mourn his loss. The Hatchery Department especially, the whole working force, and thousands of friends will long remember the good works of the deceased.—W. H. SHEBLEY.

GEORGE THOMPSON

While on patrol duty, endeavoring to apprehend violators, Deputy George Thompson of Gridley, California, was shot and killed by Charles Hogaboom, an alleged demented rancher of Pennington, Sutter County, on September 7, 1928. George Thompson was one of the most faithful, industrious men on the force. He knew ducks and their habits for he was, as a young man, a market hunter. Yet experience had shown him the dangers of wholesale destruction and he made a better warden for his early experiences in hunting. His knowledge of wildfowl furnished him with the ability to imitate their calls. He was considered one of the most expert men in the state in calling ducks and geese. He fearlessly enforced the game laws and won the confidence of his district.

George Thompson was a native son, born in Sutter County in 1880. He became a deputy fish and game commissioner in 1921 and by diligence established an enviable record. It was never too early or too late for him to be in the field. Many a night was spent in the tules attempting to catch "ground sluicers." For many years he engaged in farming He is survived by a wife and four children, two boys and two girls. Though but small consolation for the loss of husband and father, they are privileged to remember that he was killed while doing his duty. Deepest sympathy goes to the bereaved ones from his fellow workers.—H. C. B.

GAME COMMISSIONERS MEET AT SEATTLE

A joint meeting of the American Fisheries Society, the Western Association of State Game Commissioners and the International Association of Game, Fish and Conservation Commissioners was held at the Olympic Hotel in Seattle, Washington from August 27th to 31st. This was the 8th annual meeting of the Western Association of Game Commissioners, the 22d annual meeting of the International Association, and the 58th annual meeting of the American Fisheries Society. The first two days were devoted to the joint program of the first two organizations, while the remaining three days were devoted to the program of the American Fisheries Society.

This was a meeting of conservation officials, experts and enthusiasts from the United States and Canada. Many addresses and papers were given and much discussion engaged in on all phases of fish and game conservation. Each of the three organizations gets out a printed report of the meetings and all of the papers and the discussions will be available for any who are interested. One of the greatest benefits to be derived from a meeting of this kind is actually to meet and to exchange ideas with those who stand out as leaders in the conservation movement in North America.

There were in attendance from the California Division of Fish and Game, President I. Zellerbach who delivered an address based on his experience as president of the California Fish and Game Commission; Mr. Eugene D. Bennett, executive officer, who, when the roll of the states and provinces was called, answered with a short talk on the organization and work of the California Division of Fish and Game; Mr. E. C. Scofield, who gave a paper on the striped bass investigations in California; and J. S. Hunter, Roy Ludlum and N. B. Scofield, who helped enliven the discussion and served on various committees.

The next meeting of the Western Association of State Game Commissioners is to be held in San Francisco at a date to be decided upon later. President Zellerbach received the honor of being elected the next president. The other two organizations will hold a joint meeting at Minneapolis next year during the week commencing September 9th.

Addresses especially worthy of note given at the Seattle meeting were: "Bear River Marsh as a National Project," by David H. Madsen, Superintendent Bear River Marsh Migratory Bird Reserve, Utah; "Measures for Better Protection of Wild Life," by Colonel Paul G. Redington, Chief, U. S. Bureau of Biological Survey; "Alaska Salmon—an Achievemen in Conservation," by Henry O'Malley, U. S. Commissioner of Fisheries; "A Canadian-American Salmon Reclamation Project," by John Pease Babcock, Chairman, International Fisheries Commission, British Columbia; "Work of the International Fisheries Commission," by Will F. Thompson, Director, Scientific Investigations; "Development of the Oyster Industry of the Pacific," by Professor Trevor Kincaid, University of Washington; "Effect of Paper Mill Waste on Young Salmon—Means of Prevention by Disposal," by H. W. Nightingale, Sanitary Engineer, Washington State Department of Health; "Harbor Seals of Northwest Coast Country," by T. H. Scheffer, Washington, U. S. Bureau of Biological Survey. There was a symposium on fish propagation which included research on fish foods, conducted by John W. Titcomb,

Superintendent of Fish Culture for Connecticut. There was a group of papers on "Problems Relating to Reclamation and Power Projects." There were other valuable papers too numerous to mention here. One evening was given over to an illustrated lecture on "Bird Life," by Dr. T. Gilbert Pearson, President, National Association of Audubon Societies. The Thursday session of the American Fisheries Society was held in the open air at the beautiful grounds of the state's Green River Hatchery to which those in attendance were taken in motor cars. A picnic lunch was served on the grounds. On Wednesday evening was the International Wild Life Dinner, in the Venetian Gardens of the Olympic Hotel.

All who are interested in conservation should secure printed copies of the transactions of the three organizations. Most of the papers will appear in the Transactions of the American Fisheries Society. The Transactions have been issued for a period of 58 years and contain most valuable contributions on fish culture, fisheries science and conservation of the game and commercial fisheries. The report of this organization has grown until it contains over 300 pages and no better investment can be made by anyone interested than to take out a membership in the society which costs $3 and secure the publications as they are issued.

HUNTER VS. FARMER.

The hunter continues to accuse the farmer of selfishness when he is ordered off the owner's land. The farmer complains bitterly that the hunter has no respect for other people's property. The situation appears to be growing more acute. One of the Portland papers has carried a series of articles under the heading, "A Farm Woman Speaks." The articles point out that in self defense "no hunting" signs were put up, but did little good. It is also pointed out that often tame quail which are feeding in the farmer's yard are shot by the careless hunter. The question is even broached. "Why is there no farm representation on a game commission when the farmer has such a personal interest in game?"

One wonders how the average farmer can be induced to protect and increase the game on his land if he does not receive fair treatment from the hunter who claims a right to take the game which law says belongs to the commonwealth and not to the owner of the land. In spite of pleas continually made to the sportsmen, conditions show but little improvement. However, here in California, there is an earnest endeavor being made to hold the respect and support of the man who really helps raise the game shot by the hunter. When a new fish and game protective association is formed, the assembled members are always asked to pass the following resolution. If sportsmen would indeed follow these injunctions the problem could be solved.

WHEREAS, It is generally concluded that great and irreparable injury and damage is done to the property of farmers and land owners by irresponsible hunters and fishermen; and

WHEREAS, It is the object and aim of this association to create a better understanding of the rights of the farmer and land owner and more appreciation for the privileges granted the sportsmen by the farmer and land owner, be it

Resolved, by the members of_____ _____ Fish and Game Protective Association, that they will not hunt, shoot or fish on any enclosed or cultivated lands that are private property without first having secured permission so to do from the owner or tenant of the lands; and be it further

Resolved, That upon requesting permission or having been granted such permission the members of this association will voluntarily exhibit to the owner or tenant of the lands their membership card in this association together with their hunting or fishing license.

A CHANGED VIEWPOINT NEEDED

The pioneer hunted game purely as a meat supply. Later there were days when markets were stocked with every sort of game. In order to save wild life resources, it became necessary to stop the sale, and add numerous restrictions on the taking. At present, a changed viewpoint is necessary. Everyone must admit that the greatest usefulness of game is not to be found in its meat value, but in its recreational value. Furthermore, it is coming to be recognized that the mere presence of wild birds and animals is an asset. If, with changed conditions, we place a different valuation on game, there must be modification of its care. Every citizen of the state has a right to assume ownership. Each has a right to have a hand in game administration. Wild life resources must be administered in a progressive manner coincident with changing conditions. Fifty years ago, game was considered useful only to those who killed it for food, today game in some places has a usefulness to those who would go out and see it alive in the open. Proper utilization will come only when study has revised the importance of each contributing factor.

CONSERVATION TRAINING CAMP FOR BOY SCOUTS OPENED IN YOSEMITE

State conservation leaders have for some time sought effective means of better utilizing the boy scout organization in the conservation program. This past

summer, the Bureau of Education of the Division of Fish and Game decided upon a plan involving a summer camp where an intensive course on conservation methods would be given to advanced scouts, especially selected by each council in the state. Yosemite was chosen as the location because of the availability of the nature guide staff to help in instruction. A cooperative arrangement was worked out with the executive committee of Region XII of the Boy Scouts of America whereby the Division of Fish and Game and the Yosemite Nature Guide Service were to furnish instruction and the Boy Scouts to furnish camp direction. The camp opened on August 5 with twenty-nine enrolled. The objectives to be attained were outlined and there followed studies of fish, game and fur-bearing mammals, waterfowl and shorebirds, forestry, and then conservation methods. Field trips were taken daily, including the Yosemite Hatchery, elk paddock, Yosemite Museum and a day and a half trip taking in Glacier Point and the Pohono trail. One evening Governor C. C. Young appeared and gave the boys a straight-from-the-shoulder conservation talk. This experience will long be remembered by the boys. When the camp closed on August 15 all the boys enthusiastically maintained that they had never learned so much before.

DEPUTY KILLED BY VIOLATOR

"Shot and killed while in performance of duty." Not only do we read this in connection with police officers, but also in connection with game wardens. A game warden deals with malcontents and often risks his life in performing his duty. The latest to fall victim to the rage of a man caught in a violation of the game laws was George Thompson, a faithful deputy of the Division of Fish and Game. Thompson, on September 7, started from his Gridley home early to check up on dove hunters who were reported as violating the game laws. Near Pennington, Sutter County, Thompson stopped Charles Hogaboom and asked him for his license. The violator leveled his shotgun at Thompson and shot him three times in the head. The dead warden was found later in the morning and the murderer was captured after a severe battle. Hogaboom, said to be demented, confessed. This tragedy adds a fourth regular warden to the list of those murdered since 1913. In addition, two regular deputies were injured. Two special deputies have been killed and two others injured in similar encounters.

The list of murdered and injured wardens is as follows:

Deputy George J. Rodolph, Merced County, November, 1914.

Deputy Richard Squires, San Joaquin County, December, 1916.

Deputy Ray Heacock, San Joaquin County, December, 1916.

Deputy George Thompson, Sutter County, September, 1928.

Deputy Frank Cady (injured), Lassen County, April, 1926.

Deputy Jack O'Connell, (injured), San Joaquin County, June, 1927.

Special Deputy Bert Blanchard, Contra Costa County, February, 1913.

Special Deputy Ernest Raynaud, Marin County, April, 1913.

Special Deputy John Nelligen (injured), Lassen County, April, 1913.

Special Deputy John W. Galloway (injured), Santa Cruz County, March, 1913.

It is a satisfaction to note that most of the murderers were apprehended and are serving life sentences.

STATE LION HUNTER SERIOUSLY INJURED

Jay Bruce, who since January 1, 1919, has been state lion hunter, met serious injury on June 27, 1928, resulting in the loss of the sight of one eye. The accident occurred while in performance of duty. While hot on the trail of a mountain lion in Rubicon Canyon, El Dorado County, Bruce stepped on a crooked stick which, flying upward, struck him with great force in the left eye, cutting and penetrating the eyeball. Although stunned and suffering from an excruciatingly painful wound, Bruce made his way to the place where the lion was treed. Unable to see well enough to shoot, he encouraged his son, Jay, Jr., to kill the lion. The boy failed to place a death shot and the lion got away but was treed again and shot by Bruce, whose vision had now sufficiently cleared, 400 yards farther on. The lion was skinned by young Bruce at the direction of his father, and the skin packed out to the machine. Unassisted, Bruce clambered 2500 feet up the walls of the canyon to a cabin, where he administered first aid treatment to himself.

Upon arrival in San Francisco the injured man was given medical attention at the St. Francis Hospital. Although Bruce is out and around again, his left eye records little more than light.

Unless given a helper, Bruce will necessarily have to give up lion hunting. This means that the successful control of mountain lions in California will be hard hit. Only one other man in the state has even begun to approach Bruce in ability at getting mountain lions.

NEW BUREAU ESTABLISHED

For many years there has been desultory rescue of catfish, striped bass and black bass from overflowed areas. When trout were found dying in a drained reservoir or drying-up stream, the nearest deputy usually went to the rescue. The work, though important, was sporadic and did not come within the scope of any particular department. Feeling the need for definite attention to the work of saving and transplanting fish, the Commission has established a Bureau of Fish Rescue and Reclamation with headquarters at Sacramento, and has placed in charge an experienced man. George Neale, with twenty-three years of service in fish and game conservation work in this state, will head this bureau. What this step will mean to the conservation of fish is evidenced by the August report of the bureau, which shows a total of 258,200 fish rescued and distributed to suitable locations.

THE BUILDING OF DAMS

Oregon is wrestling with the same problem which confronted California when a high dam was proposed for the Klamath River. The McKenzie River is one of Oregon's best fishing streams. Sportsmen claim that it will become another Clackamas if the dam is built. The Clackamas has deteriorated as a fly casting stream since dams were built. The power company concerned, of course, is making wonderful promises of the latest type of fish ladder. In the real fight now raging in Oregon, there is to be found at least one consolation: The fish and game commission is now considered as an interested body with some say as to power developments which may injure fish resources. Their stamp of approval is asked. Not many years ago, a state conservation board was ignored in such matters. This much is progress toward proper solution of a vexing problem.

NATIONAL WATERFOWL REFUGE LAW

The essential principles of such a bill are: the securing of ample refuge areas at the earliest possible date; certain and adequate revenue for purchasing maintenance; provision for administration which will insure efficiency free from politics, favoritism and abuses. The impossibility of reconciling all groups to unanimous support of such a bill is evident. However, it should be possible to work out a plan of reconciliation, adjustment and compromise so that there will not be involved a serious reversal of principle in case the essential results are attained. Conservationists and sportsmen should show a spirit of cooperation so that this law may be enacted.

A NEW GAME FARM

After a careful survey, a site has finally been selected for the proposed southern California game farm. The Los Serranos Country Club has agreed to donate twenty-nine acres near Chino, San Bernardino County, and negotiations are well under way to acquire this property. The site is well drained. A good water supply is available. Plans call for 364 pens in a vermin-proof enclosure. There is hope that construction will be of steel rather than of wood. In addition a large open rearing field planted to alfalfa will be provided.

FOLSOM FISHWAY REPAIRED

During the high water season of this year, parts of the fish ladder at the dam at Folsom became so filled with boulders that much criticism was forthcoming from neighboring county sportsmen. Deputy G. I. Fleckenstein helped in solving this vexing problem. Captain Larkin, working in cooperation with the state and Pacific Gas and Electric Company, who jointly own, control and maintain this dam, undertook to put the same in good condition. Twenty-three convicts were placed upon the work for about three to four weeks removing the enormous boulders. Photographs submitted at the time the work was being done show the men at work and many dead eels floating on the water at the foot of the dam.

STATE FAIR EXHIBIT, 1928

The permanent panorama exhibit at the State Fair, at Sacramento, in September, was remodeled to depict a winter scene in the Lake Tahoe region. The exhibit was under the direction of W. H. Shebley. The lighting effects were beautiful and the ponds full of trout furnished realism. An added feature was the exhibit portraying the activities of the Bureau of Fish Rescue and Reclamation. The fishes exhibited in the aquaria were those rescued from overflow areas. As in past years, the division's exhibit stirred the admiration of practically every visitor to the fair grounds.

LUMBER COMPANIES PROTECT MULE DEER

Despite the fact that deer season in the mule deer country was scheduled to open on September 16, hunters were unable to hunt deer in Shasta, Siskiyou and part of Modoc counties until October 1. This was

brought about by the posting against hunters by the McCloud Lumber Company and the Weed Lumber Company, whose timber holdings cover practically all of the mule deer country. The motive in back of this action is understood to be protection against fire. It has a direct bearing, however, on the conservation of mule deer because it materially hampered the activities of the army of eager hunters accustomed to invade this territory at the opening of the season.

MUSKRATS IN KERN COUNTY

Muskrats have been reported in Kern County, inhabiting the region along some of the canals. They have proved a menace to the crops in that they cause washouts as a result of their burrowing habits.

The Division of Fish and Game is cooperating with the State Department of Agriculture by issuing no permits allowing the introduction of muskrats for use in fur farming in the areas west of the Sierra Nevada and Sierra Madre ranges of mountains. Muskrats are native east of these ranges.

THE BEAR RIVER PROJECT

The Bear River Refuge Bill was passed by Congress and received the approval of the president on April 23. The bill carries an appropriation of $350,000 for use in establishing waterfowl refuges in the Bear River marshes of Utah. Not over $50,000 of the appropriation may be used for buying land, most of the land needed being already government land. The balance of the fund will be used largely for constructing dikes to raise the level of the fresh water in the marshes so as to prevent the loss of birds from alkali poisoning.

The bill as passed permits the use of not to exceed 40 per cent of the area included in such refuge for public hunting grounds, the remaining 60 per cent to be maintained as sanctuary.

Senators Phipps of Colorado and King of Utah introduced almost identical bills on this subject. The King bill was passed by the senate. The Colton bill was passed by the house with amendments not contained in the King bill, which were accepted by the senate and the Colton bill became the law.

Hon. David H. Madsen, for years the State Fish and Game Commissioner of Utah, and one of the outstanding conservation officials in America, severed his official connection with the state of Utah on July 1, and accepted the position of superintendent of the new Bear River Bay Migratory Bird Refuge now being created by the Biological Survey under the provisions of the recently signed King Colton bill.

The construction work necessary for the reflooding of the Bear River marshes will be performed under the direction of L. M. Winsor, Bureau of Public Roads engineer stationed at Logan, Utah, who has been engaged for a number of years on irrigation projects in the west and is well fitted for the work. Mr. Winsor during the summer of 1927 made the preliminary surveys at Bear River Bay for the Biological Survey.

This important project therefore will go forward under the direction of two experienced Utah men—Mr. Madsen, fully familiar with wildfowl conditions and with wild life administration, and Mr. Winsor, familiar with construction of levees and enjoining details. Mr. Madsen has been one of the strongest advocates for the reflooding of the Bear River marshes and the creation of a refuge there as a means of preventing the appalling annual mortality of birds in that region. He planned and executed Utah's famous public shooting grounds of 30,000 acres.

It is expected that the building of dikes to store fresh water now flowing into Salt Lake will not only eliminate the death areas which killed millions of birds in the past, but will afford a feeding and breeding ground for great numbers of waterfowl. Instead of a death trap for ducks, the area should become a supply point for western North America. California is sure to profit by this development, for many ducks banded in the Bear River marshes have been taken in the great valleys of California, indicating a direct line of flight.

GAME ADMINISTRATION

The Board of Game Commissioners of the Commonwealth of Pennsylvania has issued, as Bulletin No. 10, a statement by Commissioner Francis H. Coffin outlining the history and accomplishments in game administration in Pennsylvania. In the bulletin the following significant statement is made:

"The average citizen who considers the work of game administration at all is apt to think that the most serious thing the board has to deal with is the illegal hunter or law violator. The game warden, or as we term our field man, the 'game protector,' was formerly considered as an obnoxious and pestiferous individual, who went snooping around the woods making trouble for the hunter who accidentally or thoughtlessly exceeded his bag limit, or who in some other relatively harmless way infringed the stringent laws

of the Commonwealth. This point of view happily no longer prevails among our Pennsylvania hunters, who have learned to know their game protectors as fellow sportsmen, and as men working at all times to protect and foster the best interests of sport for the average citizen. The truth is that while the police activities of the game protective force are very important, this phase of their work is only a small part of it."

THE RESTORATION OF MARSHES

In urging the necessity for restoration of marsh areas in California for use of wild waterfowl J. P. Cuenin writes the following impressive statement in the San Francisco *Examiner:*

"We have reached the stage now where we must do more than merely talk about providing breeding, feeding and resting grounds for our ducks and geese—we must act at once. Ducks can't breed in the air, they can't feed on the air and they can't rest in the air, and we have passed the stage where we can count on badly overworked nature to assist the hunters.

"Some duck shooters seem to have the idea that without the restoration of marsh areas the present supply of ducks can be maintained, but this class of hunter has evidently given little thought to the subject. A few figures may enlighten them. Nine years ago there were 174,291 hunting licenses issued in California. At that time there were 697,560 acres of marshland in the concentration points of the ducks in this state. At the present time there are more than 253,000 hunters in California, and the marsh area has been reduced to the insignificant size of 77,000 acres. Here is an increase of more than 78,000 hunters and a decrease in the duck grounds of 620,560 acres."

WINTER FEEDING

The Department of Conservation of the state of Michigan will attempt this coming year to encourage the extensive use of feeding stations for both nongame and game birds. The plan is based on the supposition that the increase of quail and certain other species in many parts of Michigan is dependent upon the successful wintering of the birds. Pursuant to the plan, the Department of Conservation has asked for information on what foods are most suitable for winter feeding of game birds, the type of location most appropriate, and the precautions which must be taken to protect the feeding birds from predatory birds and mammals.

MIGRATION OF TROUT STUDIED

It is well known that some species of trout are distinctly migratory and that dams or other obstructions block their progress. In other instances it seems possible that certain kinds of trout are largely non-migratory and that man-made barriers do not interfere seriously with the life habits of trout. However, much of the information at hand is largely guesswork, and it is quite necessary that there be an endeavor to determine the ability of trout to pass beyond dams and waterfalls. The Conservation Commission of Michigan has recently tagged 10,000 trout in order that a determination may be made as to the percentage of success attained in passing certain barriers. Work along the same lines should be instituted in California in order that dependable data may be at hand when defense is made of various power projects.

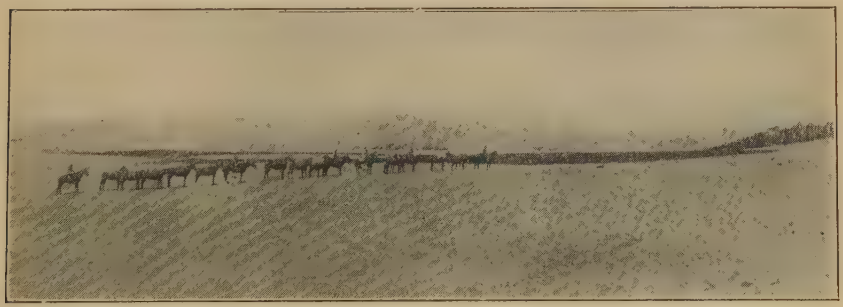

FIG. 99. Pack train with golden trout crossing a summit in Sierra in 1914. For the first time this transplantation work was reinaugurated in 1928. Photograph by A. D. Ferguson.

TO STUDY LIFE HISTORY OF PACIFIC EEL

Professor Johann Schmidt of the University of Copenhagen has started a two

years' scientific cruise in the Pacific with the intention of solving the riddle as to the spawning grounds and migration routes of the Pacific eels.

Only recently has the puzzling migration of the Atlantic eel been solved. It was known that young eels were never seen to descend a river and that old eels never went in any other direction. Young ones came up from the sea, the old ones went to sea. Finally, what is supposed to be the eggs and young of eels were found in the north Atlantic, northeast and east of the West Indies. Here the adult eels lay their eggs and then die. The young eels, which are leaf shaped, flat, thin and transparent as glass, feed on the minute water organisms and finally reach the fresh water streams along the Atlantic coast. Professor Schmidt now hopes to find the spawning grounds and work out the life history of the eels of the Pacific Coast.

GIANT TORTOISE BROUGHT TO SAN DIEGO

Last May 180 giant tortoises secured on the Galapagos Islands by the New York Zoological Society were brought to the United States to attempt breeding them at a number of different points. A breeding stock was left at Balboa, Canal Zone; in Arizona, in Texas, in Louisiana and in San Diego, California. All of the tortoises have been numbered, weighed and measured so as to furnish information as to their rate of growth. Since these tortoises have furnished mariners with a food supply through the centuries, it seems reasonable that colonies be developed in various suitable locations. On some of the South Sea islands the British government has successfully established land tortoises which have proved a valuable resource. Were they a faster growing species, they would lend themselves more readily to domestication.

MEXICAN GAME BIRD PROPAGATED

Mr. W. Leland Smith of Fairoaks, California, has been experimenting with the famous Mexican game bird, the chachalaca. During the past season, a pair of birds owned by Mr. Smith have successfully reared two clutches, and in late August were incubating a third.

FRY AND FINGERLINGS

There has been considerable misunderstanding concerning the size of the various kinds of baby fish that should be called fry and fingerlings. To clarify the terminology the United States Bureau of Fisheries has recently called attention to the generally accepted meaning, which is as follows:

Fry—Fish up to the time the yolk sac is absorbed and feeding begins.

Advanced Fry—Fish from the end of the fry period until they have reached a length of one inch.

Fingerlings—Fish between the length of one inch and the yearling state. The various sizes are designated as follows: No. 1, a fish one inch in length and up to two inches; No. 2, a fish two inches in length and up to three inches; No. 3, a fish three inches in length and up to four inches, etc.

Yearlings—Fish that are one year old, but less than two years old from the date of hatching. Fish over two years old and less than three years are commonly termed "two-year-olds." While the term "three-year-olds" may be employed, fish of this age are generally called "adults."

TEACHERS' BULLETIN No. 10

Certainly the organization in charge of the protection of wild life should champion the cause of any birds, animals or fish whose value is not properly recognized by the public. Probably no group of valuable birds suffers more criticism than the hawks and owls. Because some have been seen to destroy game, all kinds, good and bad, are killed on sight.

In a new teachers' bulletin, Mr. Donald McLean makes a plea for the protection of owls and gives short descriptions of the different kinds found in the State of California. This short bulletin will be placed in the hands of teachers in order that they may properly instruct students as to the real values pertaining to owls.

SEA LION BULLETIN PREPARED

One may view the sea lion as many fishermen view it, as a predatory species, feeding largely upon food fishes. On the other hand, one may demand protection for this sea mammal because of the interest and pleasure given to visitors to the sea coast and because of its value as a natural resource. Persons with either point of view will profit and doubtless obtain a more correct impression by perusal of a new bulletin now ready for press which gives the results of an investigation into the life history and habits of this mammal.

Mr. Paul Bonnot points out that of the stomachs examined only two contained valuable food fishes. There is no doubt that sea lions do some damage to fishing industries. On the other hand, they doubtless have a real part to play in the balance of life in the sea. These large

animals might very easily be exterminated and a real resource lost. The least wasteful and most humane method of holding these animals in check would be the killing of a certain percentage of the pups. The killing should be done by trained men and a census should be made regularly to determine the actual status of these animals from year to year. The bulletin will be fully illustrated and will bring together much valuable information relative to sea lions on the coast of California.

A GAME SURVEY

On July 1, Aldo Leopold of Madison, Wisconsin, for a number of years an outstanding attache of the staff of the United States Forest Service, was engaged by the Sporting Arms and Ammunition Manufacturers' Institute to make the first American game resources survey. Mr. Leopold has studied game matters for many years, is well known as a writer on conservation subjects, and is one of the best equipped men in America to make such a survey.

"The purpose of the survey," says the institute in its announcement, "is to collect the experience and ideas of sportsmen and other conservation agencies as to the best ways and means for inducing the sustained production of game crops. It will constitute a search for dependable basic facts. By assembling the facts and making them available to the sportsmen, the sponsors of the survey hope to stimulate the formulation of an effective program of game restoration."

DUCK TIME

The leaves on the trees are brown and sere;
The grass is withered and dead,
And the sky is blue of the deepest hue
In the narrow chinks o'erhead.
So you pause, perhaps, in the city's streets,
As you level your gaze on high,
For you hear a call, through the dim smoke pall
When the ducks go drifting by.

The lure of the wild gets in your blood,
For the tang of the wind is sweet,
And your pulses burn as you long to turn
Where the land and the waters meet;
Where the winds wail low through the fringing sedge,
And withering cat-tails dry;
Where the ripples break on a dead calm lake,
When the ducks go drifting by.

Then it's back to the wild, when the sun comes up,
And the twilight dawn fades fast,
When you lie in your blind, for you hope to find
A shot as the birds drift past.
When the pin-tails quack in the feeding grounds,
And the blue bills venture nigh,
Then a roar and flash—and the waters splash
When the ducks go drifting by.

You who are chained to your desks of wood,
In the heart of the busy hum;
Turn back a space for a breathing place,
When bracing November comes;
There's a hunter's camp, and a hunter's life,
And many a shot to try,
And tales to tell by the fire, as well,
When the ducks go drifting by.

—*The Illinois Sportsman.*

RESOLUTION DEMANDS STUDY OF WHALE

At the Tenth Annual Convention of the United States Fisheries Association, held in Buffalo, New York, in the early part of August, the following resolution was adopted:

Whereas, At the present time the killing of whales in all seas of the world where they may be taken commercially is proceeding on an unprecedented scale with the result that important commercial species are threatened with economic exhaustion if not actual extermination, and

Whereas, This great natural resource can only be properly studied and husbanded through cooperative arrangements of the nations concerned, and

Whereas, Certain other species of marine mammals such as Steller's sea lion of the North Pacific, the California sea lion ranging from the Farallon Islands southward to Central Mexico; the Guadalupe fur seal formerly found along the coasts of California and Lower California; the northern elephant seal of the same region, and the Pacific walrus of the North Pacific are in danger of ruthless destruction and possible extermination, therefore

Be it resolved, That the U. S. Fisheries Association at its tenth annual convention recommends that steps be taken urging the nations to provide for an international commission to make necessary investigations as to the condition and number of these mammals, whether the supply is being endangered and to make recommen-

dations to the governments concerned as to what regulations are necessary to safeguard and perpetuate these forms, to provide for their complete utilization where the fishery is permitted and to outlaw their ruthless slaughter and where inadequate economic returns result, and

Be it further resolved, That a copy of this resolution be spread upon the minutes of this convention and copies sent to the governments concerned.

WATERFOWL CENSUSES OF BIOLOGICAL SURVEY DEVELOPING VALUABLE CONSERVATION DATA

Efforts to ascertain the fluctuations in the abundance of migratory waterfowl in North America, undertaken by the Bureau of Biological Survey, United States Department of Agriculture, one year ago and persistently followed up since then, are meeting with gratifying success. The accomplishments already indicate that the original conception of the project was conservative, not over-enthusiastic, and that information will ultimately be derived from the censuses that will be of inestimable value in the formulation of a sound policy for the conservation of the country's waterfowl resources. The birds under consideration in this far-reaching cooperative undertaking include not only the ducks, geese, and swans, which collectively are termed "waterfowl," but also the American coot, or "mudhen."

It will, of course, be necessary to have the second year's observations as a basis for computations of increase or decrease of species or of waterfowl as a whole, but several very interesting facts have already been brought out by the censuses up to the present time. Owing to the surprising response that has been made to the requests for cooperation, the vast store of information gathered in the first year of the work has been far in excess of any reasonable expectation. The data obtained have been filed and indexed for ready reference.

These results show particularly the winter concentration areas in the United States during the past year and the striking fact is brought out, more clearly than ever before, that the birds that breed in Canada and migrate over the United States withdraw into surprisingly small areas for the winter. These areas lie chiefly along the Atlantic Coast from Long Island southward; along the Gulf Coast; up the lower Mississippi Valley; along the Pacific Coast; with comparatively few scattered, relatively small areas throughout the middle and western United States. In addition to this, the waterfowl, chiefly ducks, that winter in Mexico are gathered into about six important areas, from which unfortunately very little information was received during the past year, and which must needs be covered adequately in order to supplement the information now available. Among the most important of the other facts brought out by these waterfowl censuses are the movements of the bulk of the waterfowl east and west, as well as north and south, particularly during migration, the location of the bulk of the birds during different months, and monthly fluctuations in these movements.

To show these facts, a series of preliminary maps has been prepared indicating conditions and locations of the bulk of waterfowl on each of the waterfowl census dates in the United States and southern Canada, from which areas the most satisfactory information has hitherto been received. These maps are filed in the Biological Survey offices, as well as the other information gathered through these waterfowl censuses, and will become more serviceable when all necessary data can be more carefully analyzed and examined and any errors eliminated, for in handling a project of such magnitude it is of course necessary and desirable to exercise all possible precaution to see that the deductions from the data considered represent the true conditions.

One of the most encouraging features of the past year's organization and conduct of these waterfowl censuses has been the almost universal interest and cordial offers to cooperate that have been met with everywhere. The purposes of these censuses are apparently appreciated and the method fully approved by those to whom it has been explained, and the future success of the work seems assured. The Biological Survey hopes to enroll additional observers as soon as possible, particularly in Canada and Mexico, to cover all the important concentration areas, so that the facts gathered may approximate as nearly as possible the exact waterfowl conditions over the North American continent.

DIVISION ACTIVITIES

The Division of Fish and Game was very well represented at the recent meeting of the International Association of Fish and Game Commissioners at Seattle. Meeting was held jointly with the Western Association of Fish and Game Commissioners and the American Fisheries Society from August 27 to September 1. Commissioner Zellerbach was elected president of the Western Association for the coming year. The date for the meeting next year has not been selected but the meeting will be held in San Francisco some time in the fall. Both Mr. Zellerbach and Mr. Bennett took an active part in the discussions at the meetings, as did Mr. Scofield of the Commercial Fisheries Department. David H. Madsen, of Utah, was elected president of the International Association. Our California Division of Fish and Game was represented on the executive board by J. S. Hunter. The next meeting of the International Association will be held in Minneapolis, Minnesota, the week of September 9, 1929.

In conjunction with the American Fisheries Society, W. F. Thompson, formerly of the California State Fisheries Laboratory, gave a paper on the work of the International Fisheries Commission between the United States and Canada appointed for the study of the halibut of the North Pacific. A paper was also given by E. C. Scofield on the striped bass investigations which he has been carrying on for the Division. Other especially interesting papers given were: "The Development of the Oyster Industry of the Pacific," by Professor Trevor B. Kincaid, and "The Harbor Seals of Northwest Coastal Country," by Theodore H. Scheffer.

Department of Patrol

A total of $9,141 was imposed in fines as a result of the 240 arrests made during July. These figures exceed those of any other month this year.

A few of the more interesting cases which were made during the summer are as follows:

One San Francisco citizen started out on his vacation. He neared Modesto at dinner time and being hungry, and seeing a nice flock of quail crossing the road, he proceeded to kill some. Deputy Magladry happened to be in this vicinity and took him into Judge Rice's court, where he was fined $200.

A man of Dos Palos wished to treat one of his San Francisco friends to a feed of doves and a few nongame birds. He sent nine doves and three or four nongame birds by express to his San Francisco friend. Deputy J. L. Bundock found the package in the express office; seized the birds, and Deputies Blewett and Gourley of the Los Banos district were notified. They located the violator in Dos Palos. He was fined $275 by Judge Hales.

One of the Japanese citizens near Salinas wanted some deer meat. He went out into a canyon and killed a doe, without even procuring a license. Deputy Fred Post was watching for such people and arrested the man, took him before Judge King, of Salinas, who fined him $500 for killing a doe, and $100 for hunting without a license.

Deputies Hoke, of the Patrol Department, and Bonnot, of the Commercial Fisheries, arrested a fisherman in the Klamath River who was operating a set net. Mr. Davis, a new judge in Requa, fined him $250.

Two young men of Santa Rosa decided they wanted some deer meat. They went into Deputy Harley Grove's territory and killed a doe. Deputy Groves took them before Judge Ellis, at Cloverdale, who fined them $250.

Four Chinese operating seine and fike nets near Hood in the Hood Canal were apprehended by Deputy Charles Sibeck. Judge W. E. Everson at Elk Grove assessed each offender $200.

Possession of deer meat on July 30, was a costly thing for A. B. Stocking, of Boulder Creek. Deputies Forrest McDermott and Jules Vissiere, of Santa Cruz and Watsonville, following up a tip that Stocking had deer meat in his possession, made an investigation at the mill of the Santa Cruz Lumber Company. The defendant refused to tell who gave him the meat, but entered a plea of guilty when brought into court. Judge Younger gave him the alternative of paying the fine or spending 250 days in jail, and after lecturing him severly suspended $50 of the sentence.

In checking the summer monthly reports of the volunteer deputies it was found they had checked 7632 hunting and fishing licenses, patroled 100,198 miles of streams, game fields and coast lines, made and assisted in making 77 arrests for violations of the fish and game laws in which cases fines in the sum of $1,880

were imposed. The above mentioned reports do not include fines in the sum of $950 imposed for arrests made by county fish and game wardens who hold volunteer deputy appointments in the southern part of the state.

Department of Fish Culture

The summer months are busy ones for the Department of Fish Culture. Special care must be taken to guard against disease and losses due to warm water. This makes it necessary to plant surplus fish in the hatcheries to allow room for those to be aged. The preparations must be made also for the hatcheries to be ready to receive the eggs taken from the fall spawning trout.

In the Yosemite National Park Hatchery there are several species of trout in the aquariums which were collected by Mr. Townsley, chief ranger for the National Park service, who was assisted by Governor C. C. Young and employees of the ranger service of Yosemite National Park. An effort is being made to get rainbow trout from Lake Eleanor for the aquariums. Trout from the hatchery have been distributed in streams within the park and waters outside the park boundary.

An aquarium was set up outside the Big Creek Hatchery and the fish were brought down from Prairie Creek for experimental purposes. Brush was cut and a clearing made for a new road on the grounds.

George A. Coleman, biologist for the fish culture department, has been investigating the bluestoning of lakes and reservoirs in San Diego County. Reservoirs often serve as domestic water supply, recreation and fishing grounds. Therefore bluestoning to kill algae must be supervised to prevent killing of fish. The main sources of sport fishing in the county need safeguarding.

Over 600,000 golden trout eggs were received at the Mt. Whitney Hatchery from Cottonwood Lakes. Of these, 55,000 were shipped to Bozeman, Montana and to the New York Aquarium at the request of Charles H. Townsend, Director. The take of golden trout eggs was above normal this year. The Cottonwood Lakes were planted three years ago, and half of the eggs taken were from fish planted at that time. Twenty-five thousand more of the eggs were shipped to the Caledonia Hatchery, New York.

A survey was made of the lakes in the high Sierra with the end in view that these lakes might possibly furnish eggs to be hatched at the Mormon Creek Hatchery, near Sonora. However, it is believed that it would be too difficult to reach these lakes early enough to secure spawn.

Fish were planted from the Kaweah Hatchery during the latter part of July. It was necessary to distribute them early as the water during mid-summer becomes full of algae and water moulds which are injurious to the young fish.

For the second time, to the knowledge of the Department of Fish Culture, an epidemic broke out among the fish west of the Rocky Mountains. The disease, resulted in the loss of two-thirds of the fish at the Big Creek Hatchery. The hatchery was quarantined and specialists engaged to study the problem.

Department of Commercial Fisheries

During July, Dr. Henry B. Bigelow carried on intensive oceanographical study in the waters near Monterey. He was assisted by E. C. Scofield, of the Commercial Fisheries Department, and allowed the use of the patrol boat *Albacore*. It is hoped that from this work a better knowledge of ocean conditions will enable us to predict fluctuations in the abundance of sardines at Monterey.

Work is being continued on the salmon investigations. A man was detailed to make a preliminary survey of the salmon spawning grounds. He later spent some time at Monterey taking scale measurements from salmon landed there.

Investigational work is also being continued on the striped bass.

Since the *Albacore* was in use at Monterey, it was necessary to charter another boat, *Salt*, for the purpose of patrolling the closed district around Catalina Island. Many cases were made of purse seiners seeking bluefin tuna. They were compelled to pay several hundred dollars in fines for fishing and having nets in their possession in a closed district.

Thornley and Company, San Diego, interested in the kelp industry, is undergoing a reorganization and expects soon to ask for a lease on kelp beds. There are only two other companies interested in this industry, Philip R. Park, San Pedro and Pacific Marine Products Co., Chula Vista.

Two new fish bulletins are completed and available for distribution. Fish Bulletin No. 12 by Dr. Frances N. Clark points out the significance of the length-weight relationship in sardines. Fish Bulletin No. 13 by C. B. Andrews deals with seasonal trends in average size of sardines at Monterey. Other bulletins are partially completed and will be ready for publication sometime next year.

The State Fisheries Laboratory has assisted Mr. H. L. Kelly, who is connected with the Division of Fish and Game of the Agriculture and Forestry Department, of the Territory of Hawaii, in procuring some clams and abalones for shipment to Honolulu.

Bureau of Research

A predatory animal trapper was stationed during June in Game Refuge 1-O in El Dorado County. This assignment was made upon receipt of information that there was a large number of coyotes in this district that were destroying game.

The chemical laboratory which was formerly located at the offices of the Division in the Postal Telegraph Building was moved to the Hooper Foundation for Medical Research, where added facilities are available.

FIG. 100. Convicts working on fish ladder at Folsom dam. Dead eels in pool beyond. Photograph by G. I. Fleckenstein, July 2, 1928.

E. C. O'Roke, the parasitologist employed by the Bureau of Research, is continuing his work on the investigation of blood parasites of quail. His first report appeared in CALIFORNIA FISH AND GAME, Volume 14, Number 3.

Dr. Henry Van Roekel was employed to conduct pathological investigations. He is working at the Hooper Foundation

under the supervision of Dr. K. F. Meyer, director of the foundation. Dr. Van Roekel has undertaken research problems at the Yountville Game Farm.

During the summer, investigations were made at Buena Vista Lake regarding the "duck sickness" which has been previously reported upon in CALIFORNIA FISH AND GAME. The ducks had all migrated and but few mud hens remained. Samples of water and soil were taken. The amount of decaying organic matter found in the water would indicate that another outbreak of "duck sickness" can be expected as soon as the birds begin to arrive in that section unless there is a very material improvement in the situation.

Bureau of Education

The director returned to the office on August 20. He reported some splendid accomplishments. The nature guide service in Yosemite took 2500 more people on field trips during the past summer than in the preceding one. The School of Field Natural History graduated twenty students, who will return to their homes to carry on conservation work. The new Boy Scout Conservation Training Camp, which stimulated interest of the boys in methods of conserving wild life, gave training to twenty-eight eagle scouts. He also reported worthwhile experiences in the various national parks visited while working with an educational committee appointed by the Secretary of the Interior.

The exhibit showing miniature mountain sheep in a natural setting has been started on a year's trip over the state, and will be shown from Lakeport to San Diego. The trip was made possible by an arrangement through the California Development Association whereby each local Chamber of Commerce takes charge of the exhibit and places it in a desirable location.

The first showing was at the San Francisco Y. M. C. A., from which place the exhibit was sent to the Hotel Oakland, at Oakland, for two weeks. Following a schedule carefully worked out by G. N. Holmes, it was shown at Berkeley, San Mateo, Palo Alto and San Jose. During the ensuing weeks it will be displayed at Santa Cruz, Hollister, Salinas, San Luis Obispo, Santa Barbara, Los Angeles (four weeks), Glendale, Pasadena, Long Beach, Santa Ana, San Diego (two weeks), El Centro, Riverside, San Bernardino, Bakersfield, Visalia, Hanford, Fresno (two weeks), Madera, Merced, Modesto, Stockton, Sacramento (two weeks), Auburn, Marysville, Oroville, Chico, Willows, Red Bluff, Redding, Yreka, Eureka, Ukiah, Lakeport, Santa Rosa, Napa, Vallejo and Martinez.

A second miniature exhibit depicting hatchery operations at the Mount Shasta Hatchery has been completed by E. S. Cheney. Already it has been on display at a number of different places. Built to scale and with motor attachment moving a truck laden with fish cans, this exhibit represents a faithful and realistic portrayal of a familiar scene at the Mount Shasta Hatchery during trout planting time.

The exhibit is fitted with a moving scroll which gives a knowledge of the scope of the division's fish cultural activities.

A series of four field trips and four evening lectures were given the members of the Labor School held at Guerneville, Sonoma County, from August 24th to 27th. About thirty people from various labor organizations were present and attended all field trips and lectures en masse.

The morning field trip on August 24th was organized to study plants and birds, primarily, while the evening lecture, illustrated with motion pictures, dealt principally with nongame birds and their relation to man's interests.

The field trip on the 25th was devoted to a study of mammals and birds. The evening lecture dealt mainly with deer and mammals and was illustrated with motion pictures. Another lecture was given the local Guernewood resort at the request of E. H. Maize, proprietor. About ninety people attended.

The morning field trip of the 26th started out to be a botanical trip, but geology cropped up on the discovery of a quartz vein, and a long geological discussion took place on the spot. So much interest was shown in geology that a blackboard lecture was given that evening before the pictures were shown.

The following morning found the group working on subjects of interest along the stream side.

This new work is most valuable in that it reaches the working class and is carried back by the members of the school to their various organizations throughout the major part of the state.

Conservation and the knowledge of wild life were the keynotes of the work. J. L. Kerchen of the University of Cali-

fornia Extension Division, director of the school, apreciated the cooperation and has asked for aid for next year.

Bureau of Hydraulics

Numerous inspections of streams were made to determine whether fish screens and fish ladders were necessary. Recommendations were made to some companies that new fish screens and ladders be installed, and in some cases different locations were suggested.

The Pacific Gas and Electric Company at Vallejo has built earthen dikes to keep the asphaltum beds and waste products that have accumulated there for ten years or more from spreading and finding their way into the channel. In addition, they have installed pumps so that the water is recirculated and the opportunity for pollution is lessened.

The Union Oil Company at Oleum has placed its collecting sumps in such a condition that the discharge water passing out into the bay is now free from oil.

The Standard Oil Company at Richmond has improved its sumps so that the discharge water is now free from visible signs of oil. About $50,000 was spent on these improvements.

It has been reported that as a result of the oil cleanup in the waters in the vicinity of Ventura, fish have been seen in the Ventura River for the first time in several years. While no accurate figures are available, it is believed that over $200,000 has been spent in this field to avoid pollution.

Following repeated warnings which apparently had no effect, three oil companies, the Carson Hill Oil Company, Marine Corporation and the Bush-Vorhiss Company, operating in the Signal Hill field, were taken into court and enjoined from the placing of oil in the natural drainage channel, from which it eventually found its way into the storm drains and into the Pacific Ocean.

The three cases came to trial before Judge Morgan Galbreth of the Superior Court of Los Angeles County, and were vigorously prosecuted by the Division. The Marine Corporation put up a stubborn defense in spite of the fact that the other two defendants defaulted. After hearing the evidence and inspecting the

FIG. 101. Site of proposed southern California game farm near Chino. Photograph by Paul J. Fair, July, 1928.

property in question, Judge Galbreth rendered a decision to the effect that the companies must keep the oil out of the natural drainage or be in contempt of court. Deputy Ed Chan of the southern district secured the evidence in the cases.

Bureau of Public Relations

In addition to the regular publicity work of the Bureau of Public Relations, a 2500 word story relating to the planting of golden trout in barren waters of California, illustrated with a number of appropriate photographs, will appear soon in the *Sunset Magazine*. It covers in considerable detail the history of the work done with the golden trout in the state since the first plant in the seventies.

Bureau of Game Farms

On June 27th the first plant of the 1928 crop of birds was made at Redding and Willows. These birds, 682 in number, were transported to their destination by the farm truck with the loss of but one bird. They were six weeks old and were accompanied by the domestic hens that had raised them.

The Bureau of Game Farms has approved the site at the Los Serranos Country Club near Chino, San Bernardino County, as a suitable location for a second game farm that will serve the southern part of the state. The stock for the new farm will be sent from the Yountville Game Farm. It will not be necessary to buy breeding stock of any kind.

One of the best ways of acquainting the public with the work of the division is by showing them first hand through exhibits what the Division is doing and the way in which it is being done. Opportunity to display game bird production by the Bureau of Game Farms was availed of in three important localities of the state during the recent fair season. At the Kern County fair, Bakersfield, the State Fair, Sacramento, and the Pacific Southwest Exposition, Long Beach, attractive exhibits of pheasants, quail, Hungarian partridges and turkeys conveyed to the sportsmen of the state that thousands of suitable birds were being propagated for liberation in depleted covers.

An employee possessed with the necessary training and knowledge to present intelligently the bureau's work to the people was in attendance during the course of each exhibit.

A number of beautifully plumaged golden, silver and Reeves pheasants are being supplied public parks upon receipt of application. The parks that secure the birds must guarantee that suitable pens will be provided and that attendants be trained to properly care for the birds and see that the right food is given them. The pheasants are to become a permanent educational exhibit and are furnished without charge.

COMMERCIAL FISHERY NOTES

N. B. Scofield, Editor.

CRAB SEASON CORRECT

There is some dissatisfaction in regard to the present closed season on crabs in Humboldt County and a desire on the part of some to have the season close earlier.

The closed season as now constituted—July 31 to November 14, inclusive—was arrived at after a number of years of trial and investigation, and it is believed to fit the conditions in the region of San Francisco. The season may not exactly fit the conditions at Eureka. There is evidence that the crab's breeding season and moulting time is a little later at Eureka than it is at San Francisco. The breeding season, which is coincident with the shedding of the shell by the female crabs, commences here at San Francisco at least by the middle of June, a month and a half before the season closes. The question then naturally arises—What is the object of the closed season? The object of the closed season on crabs is not to protect the crabs during the breeding season. *The object is to cover the period during which soft crabs would enter the nets.* The female crabs are protected at all times, as it has been found that they carry eggs, either internally or externally, practically the year round. The males are protected by a 7-inch minimum size limit, which protects them until after they have passed through one or two

breeding seasons. It is evident, therefore, that with the protection given the females, and with the size limit on males, the crab supply of any region can not be seriously depleted if the laws are enforced. But in addition we have the closed season which saves from loss the male crabs which would be discarded after they have been cooked, due to the watery condition of the meat following the shedding of the shell. At the breeding time males and females are paired and there is no inclination on the part of either sex to seek food and thus get caught in the nets. Then the shell is shed and for a considerable time the crab is unable to move about in search of food for the reason its shell is too soft. When the old shell is cast off the new soft shell underneath is capable of stretching and does stretch as the crab expands after being released from the hard shell which had become too small. This expanding of the soft crab is accompanied by the absorption of water by the crab's tissues and it is this absorption of water by the tissues that renders the crab worthless for food. The new shell then hardens and the tissues get rid of much of the water after it has answered its purpose. The crabs then take on a pithy or woody texture which renders them as unpalatable as the excess of water. After the shell is firm enough the crab moves about for food, and after the *tissues* have become firm again the season is supposed to open.

A question which often arises is: Why is our crab not good to eat when its shell is soft the same as the blue crab of the Atlantic coast? The answer is: The eastern blue crab is taken and held in live cars until it sheds its shell, and it is used for food before the tissues have filled themselves with water. Our Pacific coast crab could be eaten in the same way if it could be taken just at the time it sheds its shell.

The evidence that the breeding and shedding season is possibly a little later at Eureka than at San Francisco is: After the season opens at San Francisco on November 15, no "watery" or what is called "pithy" or "woody" crabs are taken. At Eureka the fishermen have told our deputies that November 15 is too early for the season to open, for at that time a good many of the crabs are still soft and the meat not good to eat. At San Francisco a very small number of soft crabs are taken just before the season closes on July 31, while I have never heard that this occurs at Eureka. After the crabs shed their shells these shells are often washed ashore. The cast shells first make their appearance along the shore in this vicinity as early as the middle of June, and large numbers have been observed by the end of June. The reports available indicate that most of the shells are washed ashore in the vicinity of Crescent City and Little River during September. Therefore if any change is necessary in the season at Eureka, it should be a little later rather than earlier.

But in reality the closed season is to prevent the catching and waste of soft or "watery" crabs. Of course if evidence, which can be easily obtained from crab fishermen at Eureka, shows that soft crabs are taken in numbers in the crab nets before July 31, then the closed season should start earlier. From the evidence already in our possession, the season should not open any earlier.

SEASON ON SALMON AND BASS RESULTED IN POOR CATCH

When the season on salmon and bass closed this fall on the Sacramento and San Joaquin rivers, fishermen reported the poorest season in years. The fisherman's union announced they would ask for a later opening and for further restrictions on the taking of salmon.

LIBRARY OF CALIFORNIA STATE FISHERIES LABORATORY

People interested in fish and fisheries who have not discovered the library of the California State Fisheries Laboratory (situated at East San Pedro) have a most gratifying surprise awaiting them.

Organized in 1919 at the time of the founding of the laboratory, the library has increased rapidly until it now consists of about four thousand volumes and comprises the major portion of the literature dealing with fisheries problems. Here can be found government and other publications on fisheries biology in every language from Finnish to Japanese. Practically all the literature published on the great fisheries of the North Sea is to be found on these shelves. Mediterranean fisheries literature is well represented and English and American publications are nearly complete.

The library covers not only the scientific aspects of the fisheries problems but also includes publications issued by commercial organizations. The important fisheries trade journals of America, England, France and Germany are shelved here. He who wishes to know the market conditions for Norwegian herring or the problems confronting the German carp ponds finds this information awaiting him.

Besides literature immediately connected with fisheries work, this library has extensive series of publications on oceanography, for to understand our fisheries industries and the behavior of fishes, we must try to understand the waters in which these fish live. Also, any biological study of today demands statistical analysis of the data at hand. The library fills this need by furnishing all modern texts on statistical subjects and current and past issues of statistical journals.

In addition to detailed literature on the scientific aspects of fisheries biology, this library contains works on general biology, general zoology, hydrology, meterology and fisheries technology. Here the inquiring mind may secure information on the life history of the whale, the water temperature of the Pacific, the ocean currents in the North Sea, the air temperature of Los Angeles, or how to tan shark's skin.

As varied as the scope of the literature contained in this library, are the types of people who come to consult its volumes. The major users are the fisheries biologists working at the laboratory, but also fisheries workers from the whole Pacific coast avail themselves of its resources, both by visiting the library in person and by borrowing books through other libraries and directly by mail. The bibliographical resources are such that specialists in other fields of biology come to this library to consult its vast lists of publications.

Also in this library frequently are to be seen members of the fishing industry: A commercial fisherman who has found an unusual fish which he wishes to identify; a fish canner who wants information on some new or old method of preserving fish; a man planning to develop a fishing industry in a foreign port, wanting to learn the types of fishes available; another with a new idea about utilizing a by-product and seeking all previous knowledge available; a lawyer asking about the migrations of whales on which question hangs a lawsuit. People with whom fishing is a hobby find many questions answered in this fisheries library. Foremost among these questions are the names of peculiar fishes, and occasionally information is sought about special gear, how to make plankton nets, and what will be the effect on fish life, of structures built in streams or bays. Also, high school and college students come in their turn to get information on which to base term papers and theses.

In all cases the personnel is most willing to be of service and prompt attention is given to questions relating to fisheries.

THE EFFECTS OF STREAM POLLUTION ON FISHES AND THEIR FOOD

A paper by Stephen A. Forbes with the above title has just come to our notice and on account of its intrinsic interest is reviewed although it first appeared in 1926.*

Since 1894, the Natural History Survey of Illinois has been studying pollution conditions of the Illinois River and in 1923 started observations on the Illinois portion of the Rock River. The Water Survey of the state of Illinois cooperated by handling the chemical and bacteriological questions.

Sewage pollutions are of two principal kinds, organic, and chemical or mineral. The former is from households, slaughter houses, dairies, tanneries, pulp mills, etc.; and the latter from gas plants, metal industries, chemical industries, oil refineries and salt works. Organic wastes are subject to decomposition and during the process use up oxygen and add carbon dioxide to the water in quantities injurious to the fish. Chemical wastes do not decay and their effect on fish life ranges from harmless to fatal, and is the result of the poisons acting directly on the tissues, especially the gills.

The difference in reaction of fishes to the two kinds of pollution is interesting. The more sensitive (and more desirable as food) avoid water badly polluted with organic waste while the less sensitive, such as carp and buffaloes, seem to be attracted by it. Chemical poisons do not repel fish and in some cases appear to attract them. Occasionally fish are killed outright with chemical poisons but never with organic. In all cases fish living in polluted water absorb unpalatable flavors.

Experiments on the Illinois River in 1915 showed 5180 pounds per acre of small bottom animals such as make up the food of fishes. In 1920 after five years of increased pollution there were only 240 pounds per acre, a reduction of 96 per cent. This river is large and slow moving and shows a strong contrast with the Fox River, which is smaller and shallower and practically normal 2½ miles below the towns that use it for sewage disposal.

* Read to the Annual Convention of the Izaak Walton League of America, in Chicago, April 9, 1926. Reprinted from Outdoor America, September, 1926, by Illinois Department of Registration and Education, Natural History Division.

There are three marked phases of river pollution. In the earliest the organic contents are unchanged and are eaten by adult scavenger fishes. No young fishes of any kind are found in this section. As decomposition takes place the clean water animals disappear and are replaced by sewage fungi, sludge worms, midge larvae. It is easily seen that the bottom conditions are worse than those of the water since the water is purified by contact with the air, whereas the stream bed is continually being coated deeper with filth. The gases forming on the bottom cause worm-and-larvae filled cakes of sediment to break away and rise to the surface. Further decomposition brings about the third stage in which nitrites and nitrates are formed and act as fertilizing agents of the stream. A more abundant growth of plants and animals results, than is found normally. An interesting question then arises: does this added enrichment compensate for the loss farther upstream, and make possible a denser fish population? Before this question is answered another must be settled: is food a limiting factor for the number of fish in a stream? Observations on the Illinois River have shown that it has an abundance of food for a larger stock of fish than it carries. Then one must conclude that food is not a limiting factor and that an added supply does not increase the number of fish.—Genevieve Corwin, September 4, 1928.

FIG. 102. Successful lion hunters with their kill. Charlie Leadshaw and Ross Harry secured these two lions on the north fork of the main Stanislaus River in March, 1928. Photograph by John Balestro.

REGULATION OF HALIBUT FISHERY PROPOSED

Birger R. Headstrom, of Medford Hillside, Massachusetts, made the following interesting summary of a report submitted by the International Fisheries Commission, in *Science*, August 31, 1928:

"A recent report by the International Fisheries Commission reveals that, should the present rate of halibut fishing be continued for any length of time, the industry will be reduced to insignificance. Accordingly, a movement to save it is well under way, and stringent regulatory measures have been proposed.

"It is pointed out that not only has there been a fall in the abundance of fish, especially on the older banks, which has fallen to 16 per cent of the abundance in 1906, but there has been a decrease in the size of fish, this being regarded as especially serious because of

the very slow growth of halibut, As an adult fish is from twelve to twenty-five years old, the fish to be caught in the next ten years are already hatched and the yearly abundance for that period has been established. If these fish are greatly reduced in numbers and the present *intensity* of the fishery is maintained, according to the Commission, the outlook for a stock of spawning fish sufficient to maintain the supply is rather hopeless. In fact, few mature fish are now found on the older banks.

"Although there is a complete cessation of halibut fishing for three months each year, this measure is not adequate. The Commission recommends as a minimum requirement that the halibut fishing be limited annually to some fixed proportion of the existing stock. In agreement with the best scientific opinion, it concludes that the taking of a fixed proportion of the halibut equal to that at present taken might ultimately stabilize the industry, since there are indications that the fish could survive under such conditions. Another measure proposed is the closing of two 'nursery areas,' one off Massett Graham Island, B. C., the other off Noyes Island in southwestern Alaska. In fact, the ultimate closing of all such areas is recommended. Furthermore, general restrictions are regarded as indispensable."

LIFE HISTORY NOTES

DUCK MIGRATION BEGINS

For several years I have watched the migration of ducks on Mission Bay, San Diego County. As a rule, the southward flight of pintails begins about the middle of July. This year, although I saw fifteen birds on that day, the main flight has been later than usual. These ducks appeared in increasing numbers until about September 1, when the full flight was on. Apparently these birds stop for but a short time and then proceed farther south.

Two black sea brant and three pintail ducks have remained on the waters of Mission Bay throughout the summer.—Ad. B. Pearson, North San Diego, California.

FEMALE PHEASANT ASSUMES MALE PLUMAGE

There is in our collection of mounted birds a beautiful specimen of the ring-necked pheasant (*Phasianus torquatus*), female. This bird was presented to us alive on the third day of January, 1928, by our mutual friend, Mr. Clarence L. Hopkins of this city, who raised it from a chick, and at the time it came into our possession was about eight years old. During its life time it laid about 280 eggs, many of which were hatched under a bantam hen, as she never evidenced any desire to set, although at diverse times she would gather a few eggs together, evidently for the purpose of nesting. In the year 1926 she quit laying, and from that time on commenced to display an abnormal plumage, commencing at first with flecks about the head, then a ring on the neck, feathers on crown, neck, back changing to that of the male, a well developed ring around the neck, tail elongated and barred, rump feathers, breast and belly the same as the male bird. To all appearances one would take it to be an immature male, except that there are no signs of comb, gills nor pouts feathers from the ears. When the bird was killed in the interest of science an examination of the body was made by the writer. It was very fat, particularly on the breast and intestines; the heart, lungs, liver, gizzard and other vitals seemed to be normal. An examination of the genital organs revealed that the ovaries were completely atrophied, not a semblance remaining, and the ovarian duct had dwindled to the size and color of a slate pencil. We are at a loss as to what may have caused this abnormal change in the plumage.—W. F. Peacock, Marysville, California.

CONSERVATION IN OTHER STATES

MAINE CLOSES SEASON ON MOOSE

Last year the state of Maine opened the season on bull moose. This was the first time for many years that this game animal was allowed to become the mark of the gunner. It is believed that the total kill amounted to 100 animals. However, a statement from the Department of Inland Fisheries and Game is to the effect that moose are not plentiful enough in Maine to warrant another open season for some time to come. This great American game animal is available to the hunter only in the state of Wyoming, the territory of Alaska and the provinces in Canada.

PENNSYLVANIA RELEASES 80,000 RABBITS

The Pennsylvania State Game Commission has announced the release of the largest number of cottontail rabbits ever purchased and released for stocking purposes in any one year, says a bulletin of the American Game Protective Association. A total of 80,564 rabbits were distributed during the latter part of the winter.

All of these animals were procured from dealers in Missouri and Kansas, who guarantee that no stock handled by them is affected by the dreaded and mysterious tularemia or rabbit fever. All animals are in perfect condition when leaving the dealers' hands. Upon their arrival at the various points in Pennsylvania where they are to be released they are promptly cared for by the game protectors, and any sick or imperfect animals are weeded out. They are shipped in new, clean crates and are given the best of attention on their journey.

The game protector often finds it advisable to keep the crated animals for a time until weather conditions are propitious. Sometimes it is necessary to take the animals for some distance. If they are released in the winter months the protector considers it part of his duty to see that food is placed in accessible situations for the animals. These rabbits are released to provide shooting for Pennsylvania sportsmen.

REESTABLISHMENT OF BIRD REFUGE IN WYOMING

There has been an area set aside for the use of the Department of Agriculture embracing 22,700 acres on the North Platte River, central Wyoming, through executive order of President Coolidge. The lands involved have been withdrawn for use for other purposes and are under the jurisdiction of the Department of the Interior. Within the area is constructed a reservoir for the use of the Reclamation Service in the irrigation of lands. The establishment of this refuge furnishes nesting grounds, as well as feeding and resting places, for migratory waterfowl, especially for ducks, in a region where open water areas are extremely scarce. Within the refuge hunting and trapping is forbidden by law, except under such rules and regulations as may be prescribed by the Secretary of Agriculture.

LICENSE BUTTONS FOR MICHIGAN HUNTERS

With the hunting season approaching, seekers of game are looking forward to donning the new license buttons that the Michigan Department of Conservation is issuing. The buttons, about 480,000 in number, have been shipped out to distribution points, so that all is in readiness for the license rush. Conservation Department officers predict that the button plan will materially cut down the number of hunters who fail to secure licenses. The badge is large enough to be seen at a distance.—*The American Field*, September 15, 1928.

NORTH CAROLINA SECURES DEER

A deal was recently completed by the North Carolina Department of Conservation and Development with former State Senator J. E. Burleson whereby approximately 400 acres of mountain land became the property of the state of North Carolina. This area contains about 350 deer, which will be kept intact, and the increase will be used for stocking those parts of the state which have become depleted, other state refuges, and some will be transferred to the state game farm of North Carolina. The fawns will be transferred, as it has been found that the older animals are frightened and kill themselves.

MISSISSIPPI REFUGE ENLARGED

A conservation measure recently approved by the President is a joint resolution authorizing the Secretary of Agriculture to accept from James B. Munn of New York City, on behalf of the United States, a gift of certain lands in Clayton County, Iowa, to become a part of the Upper Mississippi River Wild Life and Fish Refuge. These lands, totaling 488 acres in area and estimated to be worth thirty or forty thousand dollars, were donated to the government by Mr. Munn through his interest in the objects of the refuge.—*Science*, August 31, 1928.

STATE SUPPLIES PHEASANT EGGS

Ringneck pheasant eggs for hatching will be supplied free to New Jersey farmers by the State Fish and Game Commission this year as long as the surplus supply of these eggs is available from the game farms at Forked River and Rockport. Application for these eggs, the commission announces, is made to county wardens.

The breeding flocks at the game farms produce quantities of eggs beyond the hatching capacity of the establishments. A few years ago the State Fish and Game Commission inaugurated the practice of sending out settings of these surplus pheasant eggs to farmers interested in

increasing the game supply in their respective communities. This plan has been increasingly successful, and thousands of pheasants reared on home farms now supplement the supply released directly by the state warden.

OUTSTANDING ACCOMPLISHMENTS OF NEW MEXICO CONSERVATION COMMISSION

In the September, 1928, number of the *New Mexico Conservationist* there appears a section entitled "Progress in Game Restoration and Conservation," in which the outstanding accomplishments are summarized as follows:

"(1) Completion of the survey of the wild life resources of the state, and publication and wide circulation of the report covering the survey. (2) Approximating the completion of the big game refuge system, and good progress in the establishment of a system of game bird and waterfowl refuges. (3) Increase and dissemination of game through artificial means—introduction and transplantation. (4) Collecting, mounting and exhibiting at the game department offices game birds, birds of prey and small game animals for educational purposes. (5) Publication and wide circulation of the *New Mexico Conservationist.*

"In cooperation with the State Game Protective Association, other undertakings of far-reaching consequence have been carried through, most important of which are publication of the *Birds of New Mexico;* the protection of bears through legislative enactment, and better organization of sportsmen throughout the state and, through education, stronger public support in game conservation."

FIG. 103. Mt. Shasta Hatchery grounds, with Mt. Shasta in background. Photograph by Sidney Snow.

A WORTHY BILL THAT FAILED

The bill which provided for the establishment of a five-year constructive and development program for the United States Bureau of Fisheries passed both houses of congress, but was subject to a pocket veto by the President which prevented it becoming a law. This bill provided for the consolidation of several separate bills concerned with the establishment of federal fish hatcheries and fishcultural and research stations

throughout the country over a period of five years. However, as the same congress will be in power this winter, it is entirely possible that the bill may be passed and the Bureau of Fisheries given a wider opportunity for service.

ENTOMOLOGIST EMPLOYED BY MISSOURI STATE GAME AND FISH COMMISSION

The Missouri State Game and Fish Commission is making investigations of plant and animal life that may be used for fish food. K. C. Sullivan, assistant professor of entomology at the University of Missouri, in charge of this work, has found that the Niangua is one of the best fish streams in the state, and the food it contains upon which trout and bass thrive will serve to guide the Commission in its work of restocking other Missouri streams. The Commission will then be able to place the fish produced in its eight state fish hatcheries in streams best adapted to their growth and development.

NEW TYPE OF FISH FOOD

The increasing cost of liver as a fish food due to the enormous consumption for human use in the cure of anaemia has forced research departments of state fish and game commissions to search for some satisfactory substitute. A small freshwater animal which has more the characteristics of an unlikeable insect, but goes under the name of *Gammarus*, or freshwater shrimp, is expected to solve this problem for the Oregon State Game Commission. Although each specimen is only one-quarter to three-quarters of an inch long in the adult stage, a mouthful of these little animals seems to satisfy the appetite of trout and salmon in this region. Therefore, Matt Ryckman, superintendent of hatcheries for the Oregon Game Commission, has ordered several million of these freshwater shrimps shipped to Oregon hatcheries from Utah and Nevada for breeding purposes. As rapidly as this new type of food can be produced in usable amounts, it will be adopted by hatcheries as standard fish food to take the place of ground liver.

OREGON ADOPTS CONTINUING PROGRAM

The state game protective associations and many local associations have given approval to a plan of the State Game Commission of Oregon for a continuous program and policy in fish and game restoration, some of the objectives of which are the following:

Protection of streams against pollution.

Protection of streams against destruction, provision for efficient fish ladders at power and irrigation dams, and screens for irrigation ditches and power canals and outlets.

Scientific study of propagation, distribution and conservation of wild life.

An educational program including a textbook on Oregon wild life and the outdoors for schools; systematic distribution of public information, and the establishment of a department of marine biology and game administration in one of the state institutions of higher education.

It is recognized that research is necessary to obtain the facts needed in the formation of any constructive policy for management of the fish and game resources of the state. The American Game Protective Association continually advocates the establishment of a department in some university in every state for study of the problem of administration of fish and game and other wild life resources.—*American Field*, August 18, 1928.

REPORTS

FISH CASES

April, May, June, 1928

Violation	Number arrests	Fines imposed	Jail sentences (days)
Angling License Act	161	$3,750	40
Commercial Fishing License Act	12	185	---
Trout: closed season; over limit	81	2,965	130
Striped bass: over limit; undersized	49	1,460	115
Black bass: closed season; undersized; over limit	25	550	---
Sunfish, perch, crappie	25	520	---
Catfish: sale of undersized	2	50	---
Salmon: illegal sale	1	---	60
Barracuda: undersized	6	155	---
Clams: undersized; over limit	36	785	190
Abalone: undersized; over limit	92	2,405	20
Crabs: undersized; illegal shipment	8	240	---
Fish spear, illegal possession	5	125	---
Illegal fishing: within 250 feet of fishway	2	55	---
Fishing, closed district	37	1,200	75
Nets, traps, lines: illegal possession or use	17	2,125	---
Explosives: water pollution	8	700	---
Totals	567	$17,270	630

GAME CASES

April, May, June, 1928

Violation	Number arrests	Fines imposed	Jail sentences (days)
Hunting License Act	11	$275	---
Deer: closed season	43	3,910	150
Deer: does, fawns, spiked bucks	3	100	---
Rabbits: cottontail, brush; closed season	37	715	210
Ducks: closed season	1	25	---
Doves: closed season	4	50	---
Pigeons: closed season	6	200	---
Quail: closed season	8	280	---
Pheasants: closed season	2	375	---
Nongame birds: killing, possession	1	25	---
Shooting from automobile	1	25	---
Fur trapping regulations	3	30	---
Totals	120	$6,010	360

SEIZURES OF FISH AND GAME

April, May, June, 1928

Deer meat	pounds	764
Deer hides		1
Deer—fawns (alive)		3
Rabbits—cotton, brush		61
Ducks		3
Doves		8
Quail		19
Pheasants		2
Nongame birds		5
Trout		1,019
Black bass		171
Sunfish, perch, crappie		329
Striped bass	pounds	232
Shad		3
Salmon	pounds	64
Catfish	pounds	10
Barracuda	pounds	11,128
Spotfin croaker	pounds	450
Crabs		95
Clams		1,223
Abalones		205
Nets, traps		8

SUMMARY FUR-BEARING MAMMALS

Species—	Estimated No.		Average price		Estimated value	
	1926–27	1927–28	1926–27	1927–28	1926–27	1927–28
Skunk	39,074	56,438	$1.203	$1.564	$47,006.02	$88,269.03
Muskrats	13,261	24,736	.818	.709	10,847.50	17,537.82
Raccoon	15,527	19,182	5.639	5.474	87,556.75	105,002.27
Gray fox	8,498	14,242	2.132	2.504	18,117.74	35,661.97
Coyote	9,631	13,941	5.07	6.452	48,829.17	89,947.33
Wild cat	7,015	12,250	2.242	2.829	15,727.63	34,655.25
Civet cat	4,839	9,425	.656	.636	3,174.38	5,994.30
Mink	4,867	5,854	7.057	7.782	34,346.42	45,555.83
Ringtailed cat	3,477	4,368	2.633	3.281	9,154.94	14,331.41
Opossum	1,064	2,208	.80	.786	851.20	1,735.49
Badger	742	1,216	1.709	2.143	1,268.08	2,605.89
Kit fox	2,145	844	2.166	2.366	4,646.07	1,996.90
Beaver	692	700	12.905	14.097	9,530.26	9,867.90
Weasel	347	661	.765	.918	265.46	606.80
Marten	479	495	10.485	15.302	5,022.32	7,574.49
Bear	291	239	8.49	6.935	2,470.59	1,657.47
River otter	158	163	14.456	17.742	2,284.05	2,891.95
Red fox	23	123	21.50	6.489	494.50	798.15
Mountain lion	68	88	19.654	12.853	1,336.47	1,131.06
Fisher	32	29	42.357	39.281	1,355.42	1,139.15
Totals	112,230	167,202			$304,284.97	$468,960.46

The above is based on reports furnished by licensed trappers, and is an estimate of the total catch made by licensed commercial trappers. No attempt has been made to include an estimate of the animals trapped by minors under the age of 18 years, or those taken for private use, or those killed in predatory animal control campaigns.

	1926–27	1927–28
Number of trapping licenses issued	3,790	5,243
Number of trappers reporting	2,619	3,402
Per cent reporting	69.1	64.9

STATEMENT OF INCOME

For the Period April 1, 1928, to June 30, 1928, of the Seventy-ninth Fiscal Year

	Detail	Total
License sales:		
Angling, 1927	$15,441 00	
Angling, 1928	68,675 00	
Hunting, 1927-28	32,278 00	
Hunting, 1928	2,381 00	
Market fishermen's, 1927-28	1,210 00	
Market fishermen's, 1928-29	21,850 00	
Wholesale fish packers' and shell fish dealers', 1927–28	95 00	
Wholesale fish packers' and shell fish dealers', 1928–29	170 00	
Game breeders, 1928	115 00	
Fish breeders, 1928	40 00	
Trapping, 1927-28	310 00	
Trapping, 1928–29	102 00	
Deer tags, 1928	3 00	
Kelp	20 00	
Total license sales		$142,690 00
Other income:		
Court fines	$23,957 04	
Fish packers' tax	36,902 57	
Kelp tax	3 44	
Fish tag sales	1,519 57	
Game tag sales	7 14	
Miscellaneous sales	248 00	
Crawfish inspection	150 00	
Interest on bank deposits	733 15	
Total other income		63,520 91
Total income		$206,210 91

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY, AND JUNE, 1928

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	Del Norte, Humboldt	Mendocino, Sonoma, Lake	Marin	Solano, Yolo	Sacramento, San Joaquin	Alameda, Contra Costa	San Francisco, San Mateo	Santa Cruz	Monterey
Albacore									
Anchovies							52,785	106	161,305
Barracuda									
Bonito								90	
Carp		74,894		7,356	4,239	14,979	740		
Catfish				3,063	60,035	34,499			
Cultus Cod	9,491	8,119					122,477	62,339	17,370
Eels									
Flounders	539	19,980					62,522	21,538	200
Grayfish							19,605	6,530	800
Hake							21,735	19,197	80
Halibut	112,814	4,464	37				3,301	1,384	2,733
Hardhead		11,090			245				
Herring			15				12,310		300
Kingfish							4,323	10,783	17,996
Mackerel								841	292,588
Mackerel—Horse									1,851
Mullet									
Perch	17,879		13,388			3	3,572	3,615	7,567
Pike				12	71	234			
Pompano								6	2,197
Rock Bass									
Rock fish	23,242	4,371					278,141	215,037	338,564
Sablefish	122,375						13,301	27,302	9,826
Salmon	153,581	544,225		10,372	44,376	39,260	247,326	48,524	226 859
Sandabs		15,620					168,269	107,646	1,169
Sardines	87						252,550	955	189,823
Sculpin								359	
Sea Bass—Black									
Sea Bass—White									
Shad				74	188	15	82,740		
Shad—Buck				107,642	34,719	582,708			
Shad—Roe				210,580	58,419	923,975			
Sheepshead									
Skates		130					44,510	21,044	9,134
Skipjack									8
Smelt	31,333		8,981			46	19,652	37,238	21,273

Sole	1,493	70,810					1,588,391	776,297	129,165
Splittail					45	230			
Striped Bass				19,323	70,363	106,233	9,986		
Stingray									
Suckers					49				
Swordfish									
Tomcod							125	125	
Tuna—Bluefin									
Tuna—Yellowfin									
Turbot			2,081				900		
Whitebait	79,567	2,605	28				8,722		2,506
Whitefish									
Yellowtail									
Miscellaneous	1,489	390		30		35	5,557	5,080	3,497
Total fish	553,890	755,698	24,530	358,452	272,749	1,702,217	3,023,540	1,366,036	1,436,811
Crustaceans:									
Crabs	[1]20,424						[3]1,063,944	[5]41,880	[6]4,872
Shrimps			508,326				115,832		
Mollusks:									
Abalones									792,325
Clams—Cockle		32	5,990						
Clams—Mixed	716	45	20,919						
Clams—Pismo									331
Clams—Softshell		150	16,200			7,291	2,976		
Cuttlefish							360	345	2,004
Mussels						80			460
Oysters—Eastern			[2]82,636				[4]78,265		
Oysters—Native							10,300		
Squid									1,190,227
Miscellaneous:									
Terrapins					168				
Turtles									
Totals	575,030	756,925	658,601	358,452	272,917	1,709,588	4,295,217	1,408,261	3,427,030

All amounts shown in pounds unless otherwise specified. Skipjack and albacore cleaned.

[1] 851 dozen.
[2] 375,621 shell oysters.
[3] 44,331 dozen.
[4] 355,750 shell oysters.
[5] 1,745 dozen.
[6] 203 dozen.

CALIFORNIA FRESH FISHERY PRODUCTS FOR THE MONTHS OF APRIL, MAY AND JUNE, 1928—Continued

Compiled by Division of Fish and Game, Department of Commercial Fisheries

Species of fish	San Luis Obispo, Santa Barbara, Ventura	Los Angeles	Orange	San Diego, Imperial	Total	Fish from south of the International Boundary brought into California via San Pedro	Fish from south of the International Boundary brought into California via San Diego	Total fish from south of the International Boundary brought into California
Albacore			18	17	35			
Anchovies		41,752	2,598	730	259,276			
Barracuda	9,513	2,129,006	34,841	452,914	2,626,274	2,533	5,807	8,340
Bonito		92,386	3,114	394,635	490,225		12,837	12,837
Carp					102,208			
Catfish					97,597			
Cultus Cod		141	19		219,956			
Eels		222			222			
Flounders		297			105,076			
Grayfish		42,590	188	10,251	79,964			
Hake					41,012			
Halibut	56,825	150,163	15,669	41,846	389,236		62,624	62,624
Hardhead					11,335			
Herring					12,625			
Kingfish		73,940	27	635	107,704			
Mackerel	1,799	1,813,747	469,687	806,517	3,385,179			
Mackerel—Horse		46,781			48,632			
Mullet		133		5,655	5,788		7,839	7,839
Perch	92	22,514			68,630			
Pike					317			
Pompano		259		4	2,466		10,397	10,397
Rock Bass	1,087	78,757	49,396	65,578	194,818	100	3,463	3,563
Rockfish	25,146	473,774	3,495	334,927	1,696,697			
Sablefish		1,551			174,355			
Salmon					1,314,523			
Sandabs		4,409			297,113			
Sardines	200	6,146,522	1,117	1,369,740	7,960,994			
Sculpin	68	11,245	28	2,593	14,293			
Sea Bass—Black		3,277	14,428	22,832	40,537		2,726	2,726
Sea Bass—White	6,495	205,559	1,424	51,211	264,689		31,521	31,521
Shad					83,017			
Shad—Buck					725,069			
Shad—Roe					1,192,974			
Sheepshead	975	27,190	309	1,728	30,202			
Skates		3,641	153	569	79,181			
Skipjack					8	1,121,607	276,448	1,398,055
Smelt	18,414	94,204	125	2,118	233,384			

Sole	96,275	1,122	375	113	2,664,041			
Splittail					275			
Striped Bass					205,905			
Stingray					3,296			
Suckers				3,296	49			
Swordfish								
Tomcod		1,134		29,574	30,708			
Tuna—Bluefin					250			
Tuna—Yellowfin		2,482,851	21	361,281	2,844,153			
Turbot		320			320	9,322,224	3,481,039	12,803,263
Whitebait					2,981			
Whitefish					93,428			
Yellowtail		12,813		19,039	31,852		259	259
Miscellaneous		42,951	692	207,548	251,191	29,635	53,256	82,891
	171	41,641	370		58,260		4,517	4,517
Total fish	217,060	14,046,892	598,094	4,185,351	28,542,320	10,476,099	3,952,733	14,428,832
Crustaceans:								
Crabs		[7]270			[8]1,131,390			
Shrimps					624,158			
Mollusks:								
Abalones	9,192				801,517			
Clams—Cockle					6,022			
Clams—Mixed		213			21,893			
Clams—Pismo	33,219				33,550			
Clams—Softshell					26,617			
Cuttlefish		27			2,736			
Mussels					540			
Oysters—Eastern					[9]160,901			
Oysters—Native					10,300			
Squid					1,190,227			
Miscellaneous:								
Terrapins					168			
Turtles							5,439	5,439
Totals	259,471	14,047,402	598,094	4,185,351	32,552,339	10,476,099	3,958,172	14,434,271

[7] 11 dozen.
[8] 47,141 dozen.
[9] 731,371 shell oysters.

CORRECTION

On account of delayed reports having reached this office after the original report was made up for publication, the following corrections should be made in the January, February and March, 1928, report of the catch of fish in California published in the July, 1928, Vol. 14, No. 3 issue of CALIFORNIA FISH AND GAME, page 261.

Sacramento-San Joaquin counties should read:

Striped bass	28,193
Total fish	132,214

STATEMENT OF EXPENDITURES

For the Period April 1, 1928, to June 30, 1928, of the Seventy-ninth Fiscal Year

Function	Materials and supplies	Salaries and wages	Service and expense	Property and equipment	Total
Administration:					
Executive and legal	$90 87	$4,195 00	$570 15	$560 52	$5,416 54
Clerical and office	203 65	5,049 49	880 59	198 34	6,332 07
Rent			2,095 59		2,095 59
Automobiles	112 27		52 38		164 65
Telephone and telegraph			1,811 46		1,811 46
Postage			958 52		958 52
Freight, cartage and express			713 52		713 52
Printing	4,824 10				4,824 10
Accident and death claims			471 30		471 30
Commissioners			102 75		102 75
Total administration	$5,230 89	$9,244 49	$7,656 26	$758 86	$22,890 50
Education:					
Director and assistants	$59 42	$3,775 00	$845 39	$1,418 09	$6,097 90
Publicity:					
Director		$825 00	$122 06		$947 06
Conservation and protection:					
Chief and assistants		$3,129 99	$619 29		$3,749 28
Clerical and office	$163 12	720 00	60	$48 03	931 75
Rent			116 46		116 46
Automobiles	580 43		174 11	7 90	762 44
Captains and deputies	55 63	50,239 98	42,518 81	51 19	92,865 61
Patrol launches	410 83	525 00	909 77	1,279 45	3,125 05
Lion hunting		600 00	226 30		826 30
Lion bounties			2,220 00		2,220 00
Fish planting	126 40	630 00	327 90	2,725 48	3,809 78
Refuge posting	39 75	646 71	306 53		992 99
Total conservation and protection	$1,376 16	$56,491 68	$47,419 77	$4,112 05	$109,399 66
Commercial fisheries:					
Chief and assistants	$81 22	$2,160 00	$679 42	$142 28	$3,062 92
Deputies	1,025 47	6,163 50	1,823 89	2 90	9,015 76
Patrol launches	569 00	1,185 00	253 28	149 70	2,156 98
Statistical	157 16	1,465 00	83 73		1,705 89
Laboratory	563 82	8,294 33	1,889 04	427 08	11,174 27
Salmon tagging			1 00		1 00
Botulism			3,750 00		3,750 00
Automobiles	187 27		88 16		275 43
Carp eradication	19 05				19 05
Total commercial fisheries	$2,602 99	$19,267 83	$8,568 52	$721 96	$31,161 30
Fish culture:					
Chief and assistants		$1,050 00	$13 25		$1,063 25
Clerical and office	$79 10	1,038 29	9 70		1,127 09
Rent			61 55		61 55
Automobiles	1,404 61		188 86	$4,523 76	6,117 23
Hatcheries	19,253 90	36,509 68	6,566 77	9,809 31	72,139 66
Hatcheries, additions and betterments				17,527 33	17,527 33
Special field investigation	62 70	2,261 00	1,482 91	71 02	3,877 63
Total fish culture	$20,800 31	$40,858 97	$8,323 04	$31,931 42	$101,913 74
Hydraulics:					
Chief and assistants	$101 74	$1,410 00	$555 98	$1,650 35	$3,718 07
Cooperative research work		750 00			750 00
Total hydraulics	$101 74	$2,160 00	$555 98	$1,650 35	$4,468 07
Game propagation:					
Game farm, Yountville	$2,135 66	$2,390 50	$541 88	$1,035 77	$6,103 81
Automobiles	10 60		5 00		15 60
Game farm, Southern California				97 02	97 20
Total game propagation	$2,146 26	$2,390 50	$546 88	$1,132 79	$6,216 43
Research:					
Chief and assistants	$224 00	$3,062 00	$493 80	$106 84	$3,886 64
License commissions			$9,424 45		$9,424 45
Totals, Division of Fish and Game	$32,541 77	$138,075 47	$83,956 15	$41,832 36	$296,405 75

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